PROCEEDINGS OF THE

Twenty-Seventh Annual Convention

OF THE

American Railway Bridge and Building Association

HELD AT

CHICAGO, ILL.

October 16-18, 1917

REPORTS IN THIS ISSUE

Delivery of Water to Locomotives
Erection of Plate Girder Spans
Repairing and Strengthening Old Masonry
Painting Buildings (Exterior)
Fireproofing Roofs of Wooden Buildings
Encasing Girder Bridges in Concrete
Snow Sheds
How to Secure and Hold Men
Housing and Feeding Men
Rates of Pay
The Material Situation
Reclamation of Material
Shipping Materials Economically
Material Yards

INDEX ON PAGE THREE

PUBLISHED BY THE ASSOCIATION
C. A. Lichty, Secretary
319 NO. WALLER AVENUE
CHICAGO, ILL.

S. C. TANNER
Master Carpenter, B. & O. R. R.
President, 1918

PROCEEDINGS OF THE

Twenty-Seventh Annual Convention

OF THE

American Railway Bridge and Building Association

Successor to the

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS

HELD AT

CHICAGO, ILL.

OCTOBER 16-18, 1917

Official Badge

PRICE ONE DOLLAR

BRETHREN PUBLISHING HOUSE
ELGIN, ILLINOIS
1917

OFFICERS FOR 1917-18

S. C. TANNER, ...President
Baltimore & Ohio R. R., Baltimore, Md.

LEE JUTTON, ...First Vice President
Chicago & Northwestern Ry., Chicago, Ill.

F. E. WEISE, ...Second Vice President
Chicago, Milwaukee & St. Paul Ry., Chicago.

W. F. STROUSE, ...Third Vice President
Baltimore & Ohio R. R., Baltimore, Md.

C. R. KNOWLES, ...Fourth Vice President
Illinois Central R. R., Chicago.

C. A. LICHTY, ...Secretary-Treasurer
Chicago & Northwestern Ry., Chicago.

THE EXECUTIVE COMMITTEE

Consists of the Officers and the Following Members:

ARTHUR RIDGWAY, Denver & Rio Grande R. R., ...Denver, Colo.

J. S. ROBINSON, Chicago & Northwestern Ry., ...Chicago, Ill.

J. P. WOOD, Pere Marquette R. R., ...Saginaw, Mich.

D. C. ZOOK, Pennsylvania Lines West, ...Ft. Wayne, Ind.

A. B. McVAY, Louisville & Nashville R. R.,............Evansville, Ind.

J. H. JOHNSTON, Grand Trunk Ry., ...Montreal, Que.

TABLE OF CONTENTS

REPORTS IN THIS ISSUE

(Each Subject Followed by Discussion)

SUBJECTS FOR 1918

SUBJECTS FOR REPORT AND DISCUSSION

1. Repairing and Strengthening Old Masonry.
2. Painting Metal Structures.
3. Water Supply.—
   a. Wooden Water Tanks.
   b. Sources of Supply.
4. Labor Saving Equipment.
5. Small versus Large Gangs for Maintenance Work.
6. Shipping Company Material Economically.
7. Bridge Floors and Guards.
8. Use of Concrete (Small Units).

COMMITTEES

Nominations

R. H. Reid, L. S. & M. S. Ry., Cleveland, O.
J. P. Canty, B. & M. R. R., Fitchburg, Mass.
J. B. Sheldon, N. Y. N. H. & H. R. R., Providence, R. I.

Membership

E. M. McCabe, B. & A. R. R., Pittsfield, Mass.
N. C. Ailes, D. & H. Co., Albany, N. Y.
A. W. Reynolds, P. R. R., Jersey City, N. J.
J. K. Bonner, N. Y. C. R. R., Rochester, N. Y.
A. H. King, O. S. L. R. R., Pocatello, Idaho.

Subjects

F. E. Weise, C. M. & St. P. Ry., Chicago, Ill.
E. T. Howson, Ry. Maintenance Engineer, Chicago, Ill.
C. E. Smith, Consulting Engineer, St. Louis, Mo.

Publications

Lee Jutton, C. & N. W. Ry., Chicago, Ill.
R. C. Sattley, C. R. I. & P. Ry., Chicago, Ill.
P. Aagaard, I. C. R. R., Chicago, Ill.

Arrangements

C. W. Wright, L. I. R. R., Jamaica, N. Y.
R. P. Mills, N. Y. C. R. R., New York City.
A. W. Reynolds, P. R. R., Jersey City, N. J.
O. F. Barnes, Erie R. R., Jersey City, N. J.

Relief

A. Montzheimer E. J. & E. Ry., Joliet, Ill.

Obituary

B. F. Pickering, B. & M. R. R., Salem, Mass.

Proceedings of the Twenty-seventh Annual Convention
of the

American Railway Bridge and Building Association

Held at the Hotel Sherman

Chicago, Ill., October 16-18, 1917

OPENING SESSION

Tuesday, Oct. 16, 1917.

The twenty-seventh annual convention was called to order by the president, C. F. Smith, at 10 a. m., in the Louis XVI room of the Hotel Sherman.

The president announced that the established custom would be followed of opening the meeting with prayer.

Prayer was offered by the secretary, C. A. Lichty.

The President:—Ordinarily, at these conventions, there is an address of welcome and a response as well as an address by the president but on account of the desire to give all of the time possible to the very full program of live topics which are of first importance to the members of the association it was decided to dispense with them and proceed with the business of the convention.

I do not want to allow the opportunity to pass without commenting on the fine attendance of both the members and their families at this meeting. Early in the season quite a few members recommended that the convention be postponed on account of conditions arising out of the war—the principal reason being that but few members might be able to attend. The executive committee wisely set out early to revise the program, dropping some of the subjects of lesser importance and substituting therefor live topics, giving special consideration to the labor and material situation at the present time. You will readily agree that this was the wise plan to adopt as you can see that we have the largest attendance in our history. We have members present from the extremes of Maine, Florida, Texas and

California as well as quite a sprinkling from Canada. There are also eight past-presidents present.

Now I might say that everybody here has undoubtedly been called upon to make sacrifices during the last year that have not been made for many years before,—and while we hope it will not be long until the war will end,—these sacrifices will have to be made for some time to come.

It also comes to me to say that we miss our old friend "Deacon" Patterson who passed away quite suddenly during the last year. He has attended every annual convention up to 1917 and was the secretary from 1892 until 1909. I hope that all who can will attend the memorial service in his honor here tonight.

The next order of business is roll call and as we have the card registration system in effect at the entrance of the convention hall we will dispense with the calling of the roll.

The registration showed the following members present:

P. Aagaard
W. E. Alexander
L. J. Anderson
G. W. Andrews
F. C. Baluss
H. Bender
L. M. Blake
S. C. Bowers
Z. T. Brantner
C. W. Brown
J. B. Browne
R. J. Bruce
J. E. Buckley
F. L. Burrell
W. M. Camp
W. M. Cardwell
W. W. Casey
W. Cayley
J. E. Cole
O. F. Dalstrom
W. L. Derr
I. A. Draper
H. R. Drum
W. E. Duckett
Jas. Dupree
T. H. Durfee
W. O. Eggleston
Chas. Esping
Chas. Ettinger
M. Fisher
C. F. Flint
M. J. Flynn
W. C. Frazier
Frank Gable
J. B. Gaut
B. F. Gehr
C. W. Gooch
Chas. Gradt
F. W. Graham
F. M. Griffith
Edw. Guild
L. D. Hadwen
Thos. Hall
A. W. Harlow
A. T. Hawk
W. G. Hicks
R. C. Henderson
F. J. Hodges
Peter Hofecker
G. M. Hoffman
W. T. Hopke
H. A. Horning
W. B. Hotson
E. T. Howson
A. T. Humbert
Jno. Hunciker
J. S. Huntoon
J. A. Hutchins
W. J. Jackson
A. J. James
G. H. Jennings
J. O. Jewell
C. H. Johnson
Maro Johnson
Lee Jutton
F. E. King
C. R. Knowles
W. J. Lacy
N. H. Lafountain
P. P. Lawrence
A. Leslie
C. A. Lichty
J. A. Lorch
Geo. Loughnane
B. F. Manley
G. A. Manthey
C. A. Marcy
A. S. Markley
S. W. McCaulley
D. L. McKee
W. S. McKeel
Neil McLean
A. McNab
A. B. McVay
E. S. Meloy
W. F. Meyers
A. F. Miller
J. W. Miller
G. A. Mitchell
A. Monzheimer
Homer Morgan
W. H. Mulcahy
D. G. Musser
A. B. Nies
W. M. Noon
G. K. Nuss
P. J. O'Neill
J. F. Parker
B. F. Pickering
J. O. Potts
D. E. Plank
W. F. Rankin
J. A. S. Redfield
R. H. Reid
J. V. Reynolds
G. T. Richards
R. W. Richardson
M. Riney
John Robinson
J. S. Robinson
G. A. Rodman

E. J. Rohr	H. C. Swartz	H. von Schrenk
D. Rounseville	W. G. Swartz	C. F. Warcup
R. C. Sattley	W. M. Sweeney	F. E. Weise
F. E. Shanklin	A. M. Swenson	J. B. White
J. B. Sheldon	P. Swenson	J. L. Winter
I. L. Simmons	S. C. Tanner	J. P. Wood
E. L. Sinclair	D. B. Taylor	W. E. Wood
F. P. Sisson	F. A. Taylor	C. W. Wright
C. E. Smith	J. J. Taylor	G. A. Wright
L. Spalding	J. B. Teaford	J. P. Yates
Jos. Spencer	M. E. Thomas	R. C. Young
Wm. Spencer	C. Thompson	E. C. Zinsmeister
J. M. Staten	R. E. Todd	D. C. Zook
W. M. Sterling	J. E. Toohey	
W. F. Strouse	E. E. R. Tratman	

The following applicants for membership subsequently elected, were also present:

Edward Collings	Nels Johnson	L. Spalding
John Cronin	A. D. McCallum	A. M. Swenson
O. H. Dickerson	Edwd. McGuire	C. G. Vollmer
L. H. Douglas	L. A. Mitchell	C. F. Womeldorf
H. A. Gerst	R. W. Smith	

Total number of members registered, 168.

The President:—Inasmuch as the minutes of the last meeting have been published in the proceedings and placed in the hands of all of the members we will dispense with their reading unless there is some objection. Hearing no objection, the minutes will stand approved.

I will appoint F. E. Weise assistant secretary.

We will now listen to the report of the secretary-treasurer.

REPORT OF THE SECRETARY-TREASURER

The past year has been unusual in many respects. Labor and material conditions have showed a decided unrest and for these reasons the bridge and building departments of all the railroads have had a hard time to get along.

The war has drawn on our number for at least a dozen officers while death has claimed several of our prominent members, among them our faithful secretary emeritus, Mr. S. F. Patterson.

At the last annual meeting St. Paul was voted as the location for the 1917 convention. The executive committee later saw fit to change the location to Chicago which undoubtedly was a wise move.

As far as we have been able to learn the following 7 members have died since our last annual meeting: C. G. Connolly, of the D. L. & W., died Oct. 21, 1916, a few hours after being struck by a switch engine. J. McMahon, of the Grand Trunk, died Nov. 18, 1916, from heart failure after pumping a hand velocipede while overseeing some work. W. M. Clark, of the Baltimore & Ohio, died Jan. 1 from being struck by a passenger train. James Vaughn of the D. & R. G., died March 11, 1917. S. F. Patterson died from pneumonia, in Chicago, April 17, 1917. R. J. McKee, of the Illinois Central, died June 10, 1917, after being struck by a locomotive. Walter Gaskin, of the Southern Pacific, died Aug. 29, 1917, after an operation. At the beginning of the year we had 709 members.

Delinquencies, resignations and death have reduced the number to 682.

Our revenues are dropping each year owing to a decrease in income from advertising and to non-payment of dues.

We issued 1,200 copies of the proceedings of the New Orleans meeting. Three numbers of the Bulletin were published during the year.

Number of members enrolled at close of 1916 convention,	709
Number of deaths during the year,	7
Resignations,	6
Dropped for non-payment of dues,	14
Total number of members at opening 1917 convention,	682

Financial

Balance on hand, last report,		$1,285.88

Receipts.

Dues and fees,	$1,159.00	
Advertising,	1,183.60	
Sale of badges,	23.00	
Sale of books,	59.44	
Interest,	62.00	
Total receipts,		$2,487.04
Total on hand and received,		$3,772.92

Disbursements

Postage,	$ 112.05	
Printing and engraving,	1,238.39	
Stationery and office supplies,	81.88	
Editing,	65.00	
Drafting,	8.40	
Stenographer,	112.50	
Expenses of various committees,	33.76	
Badges,	68.75	
Salaries and office rent,	800.00	
New Orleans Convention expenses,	170.30	
Telephone, telegraph, etc.,	4.00	
Charity,	100.00	
Miscellaneous,	20.10	
Total disbursements,		2,815.13
Balance on hand Oct. 15, 1917,		$ 957.79

Of the above amount $800 is out on first mortgage notes and the balance of $157.79 is on hand in the bank.

The report was adopted and placed on file. The president appointed J. S. Robinson, W. F. Strouse and P. Swenson a committee to audit the books of the secretary-treasurer.

The chair also appointed a committee on resolutions consisting of B. F. Pickering, Lee Jutton and L. D. Hadwen.

The President:—We will next take up the report of the committee on membership.

REPORT OF MEMBERSHIP COMMITTEE.

The membership committee issued the following circular, which, with a small leaflet containing information, was sent out to prospective members:

Dear Sir:—

The American Railway Bridge and Building Association cordially invites you to become a member of that Association. Your name has been suggested to the Membership Committee and we feel that you should make application for the following reasons:—

B 1. You are eligible.
E 2. The Association needs you.
C 3. You need the Association.
A 4. Co-operation with men engaged in work similar to yours on other railroads and in other parts is a privilege.
U 5. United efforts bring best results.
S 6. At the annual meetings of the Association good fellowship and interesting discussions prevail.
E 7. With every additional loyal member the Association is more effectively able to serve the purpose for which it was organized.

This association was organized 26 years ago by practical bridge and building men, with the object of advancing knowledge pertaining to the profession. It provides a clearing house for the exchange of ideas and experiences and as such has proven of great value to its members and the railroads with which they are connected. It is to the Bridge and Building department what the American Railway Engineering Association, the Master Car Builders' Association, etc., are to the other departments, and its usefulness has been recognized and appreciated by the railroads.

The Association has about 700 members among whom are many high officials of railroads who have retained their membership after being advanced. It is felt that there are many others who are eligible to membership but who have not become associated with us, probably from lack of acquaintanceship, and we are taking this means to reach all such, believing that increased membership will be of mutual advantage.

The cost is $5 for membership and the first year's dues, the annual dues thereafter being $2. The Proceedings of the Annual Conventions are published in well-bound book form consisting of about 400 pages; this alone is worth more than the cost of annual dues.

If you will fill out the enclosed application blank and send it to the Secretary, C. A. Lichty, 319 No. Waller Ave., Austin Station, Chicago, you will be elected a member at the next annual convention to be held in Chicago, Oct. 16-18, 1917.

You are also wanted to attend any of our conventions whether you make application for membership or not, the meetings being open to all who are interested in the profession.

Very truly yours,
(Signed by the Committee.)

The president also issued a circular as follows, which was sent to a number of officers of various railroads:

Dear Sir:—

I am writing to suggest to you the desirability of having your bridge engineer, bridge and building supervisors, general water service foremen, etc., become members of this Association. The Am. Ry. Bridge

& Building Association is conducted along the same lines as the Am. Ry. Engineering Association, but treats of the purely practical and constructive side of B. & B. work as differentiated from theory and design. I am convinced that the work done by the B. & B. Assn. is of inestimable value to its members, and to all men interested in B. & B. work. The present membership of the Association is about 700.

Committees each year prepare reports which are submitted and discussed at the annual convention, and printed later in the Proceedings. The Proceedings of the last few years contain more practical information in concise form than can be found elsewhere. If a member were to obtain nothing more for his annual dues than the Proceedings he would be fully repaid, and would be a more valuable man to the railroad company.

The dues are nominal. Entrance fee $3, annual dues $2,—$5 with the application blank pays for membership and one year's dues. Enclosed blanks are for distribution among your B. & B. officers who are not now members. It would be a good investment for your company to pay the entrance fees and the first year's dues of such officers as you would like to have join. Additional application blanks will be furnished promptly on request by C. A. Lichty, secretary, 319 No. Waller Ave., Chicago, Ill.

I desire to call your attention to the fact that your road has no representation at present in the membership of our Association. I hope that some of your men can join this year so that your road can secure the benefits of our meetings and proceedings. (See note below.)

At a meeting of the executive committee at Chicago a short time ago conclusion was reached to postpone the regular annual meeting scheduled for St. Paul, Oct. 16-18, and to hold this year's meeting at Chicago, in order to render it more accessible to the members. It was also decided to eliminate the purely social features and to confine the convention strictly to business, and also to postpone the consideration of some of the routine reports, and to substitute therefor special reports and papers by men specially qualified, covering the conditions as to labor and materials brought about by the war, as it was thought that the consideration of these matters by the members at this time will be of inestimable benefit to the railroads. It is hoped that your company will be well represented at the convention.

Yours truly,
C. E. Smith,
President.

(Note: Where roads had only a small representation in the Association, paragraph 4, above, was made to read: "For your ready reference I attach the names of your present officers and employes who are members of the Association. I hope it will be the good fortune of your company and this Assocation that this list be increased.")

Despite the fact that it was a difficult year, for various reasons, to solicit new member the committee, with the assistance of the president, secretary and other members, is pleased to submit the following list of applicants for your approval and election to membership.

J. D. Moen,
G. A. Manthey,
A. S. Clopton,
A. W. Reynolds,
A. J. James,
A. W. Smith,
Frank Lee,
Frank Ingalls,
Committee.

LIST OF APPLICANTS FOR MEMBERSHIP

Ballard, C. F., Carp. For., S. A. L. Ry., Peachland, N. C.
Brooks, G. E., Mast. Carp., C. R. I. & P. Ry., Rock Island, Ill.
Brown, E. H., Supv. B. & B., N. P. Ry., Minneapolis, Minn.
Coffin, S. P., Supv. B. & B., B. & M. R. R., Charlestown, Mass.
Collings, Edwd., Chief Carp., C. M. & St. P. Ry., Perry, Iowa.
Cronin, Jno., For. B. & B., C. & N. W. Ry., Winona, Minn.
Dickerson, O. H., Prin. Asst. Engr., D. & I. R. R. R., Duluth, Minn.
Dickson, G. H., Asst. Engr. B. & B., T. & N. O. Ry., North Bay, Ont.
Douglas, L. H., Mast. Carp., B. & O. R. R., Cleveland, O.
Estes, C. F., For. Brdgs., Pac. Elec. Ry., Los Angeles, Cal.
Eubanks, J. E., Br. For., S. A. L. Ry., Yulee, Fla.
Fink, Albert, Gen. For., B. & B., D. L. & W. R. R., Buffalo, N. Y.
Gerst, H. A., Asst. Engr., Bridge Dept., G. N. Ry., St. Paul, Minn.
Gongoll, O. C., Asst. Supt., B. & B., Soo Line, Minneapolis, Minn.
Hayes, J. L., Div. Engr., C. R. I. & P. Ry., Rock Island, Ill.
Heiszenbuttel, H., Genl. For., B. & B., C. & N. W. Ry., Norfolk, Neb.
Johnson, Nels, Supv., B. & B., C. G. W. R. R., St. Charles, Ill.
Jones, Pusey, Act. Engr. Strs., B. & M. R. R., Boston, Mass.
Manson, E. F., Mast. Carp., C. R. I. & P. Ry., Manly, Iowa.
McCallum, A. D., For. W. S., C. H. & D. Ry., Hamilton, O.
McClanahan, S. L., Div. Engr., C. R. I. & P. Ry., Herington, Kans.
McGuire, Edwd., Ch. Carp., C. M. & St. P. Ry., Marion, Iowa.
Mitchell, L. A., Eng. M. of W., U. T. Co. of Ind., Anderson, Ind.
Oldham, W. J., B. & B. Master, T. & N. O. Ry., North Bay, Ont.
Post, J. C., B. & B. For., L. A. & S. L. R. R., Los Angeles, Cal.
Ray, G. T., Supv. B. & B., St. J. & G. I. R. R., Marysville, Kans.
Shields, A. C., Div. Engr., C. R. I. & P. Ry., Trenton, Mo.
Smetters, S. T., Asst. Br. Engr., Sanitary Dist. of Chicago, Chicago, Ill.
Smith, R. W., Gen. For., B. & B., T. & B. V. Ry., Teague, Tex.
Spalding, Lawrence, Supv. Struct., B. & L. E. R. R., Greenville, Pa.
Spell, W. A., Ch. D'ftsman, A. B. & A. Ry., Atlanta, Ga.
Swartz, W. G., Asst. Engr. Const., G. T. R., Campbellford, Ont.
Swenson, A. M., Draftsman, C. R. I. & P. Ry., Chicago, Ill.
Vandercook, Wesley, Ch. Engr., S. A. & S. W. Ry. Sys., Lake Charles, La.
Vollmer, C. G., Ch. Carp.. C. M. & St. P. Ry. Elk Point, So. Dak.
Womeldorf, C. F., Asst. Engr., C. & N. W. Ry., Chicago, Ill.

Total number of applicants, 36.

The secretary was authorized to cast the ballot electing the 36 applicants to membership.

REPORT OF EXECUTIVE COMMITTEE

Congress Hotel, Chicago, March 21, 1917.

The meeting was called to order by the president, C. E. Smith. The members present were C. E. Smith, Lee Jutton, F. E. Weise, W. F. Strouse, C. R. Knowles, A. Ridgway, J. P. Wood, D. C. Zook and C. A. Lichty. Several other members of the Association were also in attendance.

The secretary reported on the hotel situation at St. Paul and it was decided that the St. Paul hotel was adapted to our requirements and that negotiations would probably be concluded at an early date.

President Smith explained fully the result of a conference the previous evening with the officers of the American Railway Engineering Association at which was discussed the co-operation or co-ordination of the various railroad organizations with that association and the American Railway Association. Many of the so-called "secondary" associa-

tions were represented by their president or secretary or both. (Several members from this association were present.)

It was voted that we co-operate in the future with the two associations herein named to the extent of conferring from time to time particularly on the list of subjects for committee reports so as to avoid as much as possible duplication of work, etc., keeping in mind the scope of the different organizations and that it be our desire to avoid anything that might compromise or embarrass the other associations or the railway companies.

Mr. Weise recommended that a committee of three be appointed annually hereafter immediately after the annual meeting whose duty it would be to select the list of subjects and present it to the March meeting, and after action by the executive committee proceed with the appointments of the committees on subjects for report and discussion, all of which was to be presented to the following convention for its approval,—the chairman of said committee of three to be the first vice-president.

Meeting adjourned.

Chicago, July 25, 1917.

A meeting of the executive committee was held at the Congress Hotel, Chicago, at 10 a. m. July 25, 1917, pursuant to the call of the president. The members of the committee present were: C. E. Smith, Lee Jutton, F. E. Weise, C. R. Knowles, J. S. Robinson, J. P. Wood, D. C. Zook, and C. A. Lichty. Several other members were present including E. T. Howson and C. Ettinger.

The president stated that the prime object of the meeting was to consider the advisability of postponing the 1917 convention. Letters were read from a number of members, some of whom were in favor of postponing the convention while others were in favor of holding it as usual. Upon first consideration (after some discussion) the committee was unanimous in its decision to hold a convention but it was deemed advisable to change the location of the meeting to Chicago instead of St. Paul, as was voted at the New Orleans convention. It was the consensus of opinion that it would be wise to carry over certain subjects and substitute therefor several live topics bearing on the labor and material situation and other subjects which were of timely interest to our members and the railroads in common in the present crisis.

It was also decided to eliminate most of the entertainment features except for those of the ladies who might be in attendance. A new committee of arrangements was appointed consisting of F. E. Weise, E. T. Howson and the secretary. The committee also voted to remit the dues of all members who are engaged in military service.

Meeting adjourned.

A meeting was called at the close of the Chicago convention, Wednesday, Oct. 18, 1917, at which no other business was transacted than to arrange to send a few engineering journals to our membership in France. Matters pertaining to advertisements were also discussed to some extent.

C. A. Lichty,
Secretary.

REPORT OF COMMITTEE ON RELIEF

Joliet, Ill., Oct. 15, 1917.

The committee on relief has received no requests for aid during the past year with the exception of one from a member who desired a better position.

One of our old members was materially assisted by the road with which he was formerly engaged and was also placed on the pension

roll. A check was also mailed to the same member from the funds of the association.

This association has always taken good care of its members and if at any time members hear of anyone belonging to the association who is in need of relief or looking for a position the committee on relief should be notified promptly.

Respectfully submitted,
Arthur Montzheimer,
Committee on Relief.

REPORT OF THE OBITUARY COMMITTEE

Chicago, Oct. 16, 1917.

To the Members of the Association:

The obituary committee is called upon to report the death of the following members on the dates given herewith:

C. G. Connolly, October 21, 1916; J. McMahon, Nov. 18, 1916; W. M. Clark, January 1, 1917; James Vaughn, March 11, 1917; Samuel F. Patterson, April 17, 1917; R. J. McKee, June 10, 1917; Walter Gaskin, Aug. 29, 1917.

The members of this association feel deeply the loss of their brothers who were faithful to their employers and their families and true and loyal to the American Railway Bridge and Building Association.

Therefore: be it resolved that the sincere sympathy of this association be and is hereby extended to the families of our deceased brothers and that we commend to them the loving kindness and tender mercy of the All-wise Creator who maketh and taketh away, and who is ever the comforter and strength of all who believe in Him.

Be it further resolved that a copy of these resolutions be entered in our proceedings and like copies sent to the families of the deceased members.

Respectfully submitted,
B. F. Pickering,
Committee.

The report of the committee was adopted.

Letters and telegrams were received from numerous members who regretted their inability to be present, but wishing the convention success. Among these were all of our past-presidents who were absent, besides several charter members.

President Smith introduced C. W. Gooch of Des Moines, Iowa, who received an ovation. Mr. Gooch was the first secretary of the association and stated that he well remembers the time when Deacon Patterson submitted his application for membership prior to the Cincinnati convention.

The President:—This completes the preliminary business and we will take up one of the reports of the standing committees before the noon hour.

The first report is "The Economical Delivery of Water to Locomotives." I will ask C. R. Knowles, superintendent of water service of the Illinois Central to come forward and present the report.

C. R. Knowles read the report. (See report and discussion.)

AFTERNOON SESSION

Tuesday, October 16, 1917.

The meeting was called to order by President C. E. Smith at 2:20 p. m.

The President:—The first paper this afternoon is on the subject of "The Erection of Plate Girder Spans with the Least Interruption to Traffic." I will ask Lee Jutton to come to the platform and read the report. This is a very interesting subject and I am sure it will bring out a good discussion.

L. Jutton read the report. (See report and discussion.)

Chas. Ettinger next read a report on "Paint and Its Application to the Exterior of Railway Buildings." (See report and discussion.)

The paper on "Concrete Casing for Steel Structures" was presented by the author, E. E. R. Tratman. (See report and discussion.)

The President:—The last paper on today's program is not a committee report for discussion, but is one that was written by our past president, George W. Rear, on "Snow Sheds." Mr. Rear is connected with the Southern Pacific which runs up through the Sierra Nevada mountains and has had some experience with snow sheds, as you can well imagine. One of the photographs shows snow 80 ft. deep. I am sure this will be a very interesting and valuable addition to our proceedings.

This concludes the program for the afternoon. I wish to remind you of the meeting here tonight in honor of Mr. Patterson.

Meeting adjourned at 5:45 p. m.

MORNING SESSION

Wednesday, Oct. 17, 1917.

The president called the meeting to order at 10 a. m.

The President:—The first item of business this morning will be the report of the nominating committee which will be read by the secretary.

REPORT OF COMMITTEE ON NOMINATIONS

To the members of the American Railway Bridge and Building Association:

After careful consideration the committee on nominations submits the following list of names for officers of this association for the ensuing year:

For president, S. C. Tanner,
First vice president, Lee Jutton,
Second vice president, F. E. Weise,
Third vice president, W. F. Strouse,
Fourth vice president, C. R. Knowles,
Secy-Treas., C. A. Lichty,
Members of the executive committee, A. Ridgway, J. S. Robinson, J. P. Wood, D. C. Zook, A. B. McVay and J. H. Johnston.

Respectfully submitted,
R. H. Reid,
L. D. Hadwen,
J. P. Canty,
Committee.

REPORT OF THE AUDITING COMMITTEE

Chicago, Oct. 17, 1917.

The committee appointed by the president to audit the books of the secretary-treasurer has examined the accounts and found them to be correct as shown in the report submitted to the association.

J. S. Robinson,
W. F. Strouse,
P. Swenson,
Committee.

The President:—The next in order will be the presentation of several letters on "How to Secure and Hold Bridge and Building Men." The secretary will please read the letters. (See letters from F. L. Burrell, J. S. Lemond, J. P. Wood, W. E. Alexander and E. C. Zinsmeister and discussion following.)

After some discussion of the letters President Smith suggested that before continuing it might be advisable to present F. E. Weise's paper on the subject of "Housing and Feeding Bridge and Building Maintenance Crews" in order that the discussion on the two subjects might be carried on jointly. (See report and continued discussion.)

The president gave a short talk on Liberty Bonds, after which there was presented the paper on "Uniform Rates of Pay Versus Differential Rates for Experienced Men" by E. T. Howson. (See report and discussion.)

No paper was presented on "Small Versus Large Gangs for Maintenance Work" and the president suggested that the subject be carried over for next year.

A short report was presented on the subject of "Labor Saving Equipment." The committee complained of the difficulty in getting the information from the railroads to enable it to get out a satisfactory report. (Subject continued.)

The president announced the program for the afternoon meeting when adjournment was taken at 12:20 until 2:00 p. m.

AFTERNOON SESSION

Wednesday, October 17, 1917.

The meeting was called to order by the president at 2:15 p. m.

The President:—The first paper on the program for this afternoon is on the subject of "How Can We Best Meet the Present Bridge and Building Material Situation?" The bridge and structural steel situation is particularly difficult on account of the tremendous demand of the government for steel for ships and war purposes. We are very fortunate in being able to have a paper presented by Albert Reichman, the district manager for the Chicago district of the American Bridge Company, which will bear on that phase of the subject. (See paper by A. Reichman.)

The president announced that the next phase of the subject to be considered was with reference to the lumber situation and that we would hear from H. von Schrenk as regards yellow pine material and from O. P. M. Goss concerning fir lumber from the western coast. (See remarks by Messrs. von Schrenk and Goss.)

C. R. Knowles followed with a paper along the same line with particular reference to Water Service Materials. (See paper.)

Chas. Ettinger was called upon to make some remarks pertaining to the availability of materials for painting.

Some discussion followed, citing instances where material from former bridges and buildings could be overhauled and strengthened and made to take the place of new material where it was impossible to secure new material in the present stringency. (See discussion.)

The secretary presented a short paper on the subject—"Conserving the Supply of Materials by Intelligent Reclamation." (See report and discussion.)

Mr. Camp was called upon for a report of the committee appointed to make recommendations to the association as to what further action should be taken to fittingly memorize Ex-Secretary Patterson.

W. M. Camp:—I want to say that the response from the members who contributed to the remarks made at the memorial service last evening was quite gratifying. We had 22 who made remarks and 22 letters were read. Some more letters have been received, so that so far there have been 46 memorial addresses.

I was not aware, at the time the president appointed this committee, just what was the purpose of it, but I soon found out that

there seemed to be a feeling quite generally throughout the membership that something more should be done to memorialize Ex-Secretary Patterson than what took place at the meeting last night, and many have inquired if some fund could not be provided to erect a monument over his grave.

The subject was brought up last evening in the regular manner, and the committee was authorized to find out what existing monument there was over the grave. We find that there is a family monument there but the family is willing that the association may use a tablet in some way to connect the Deacon distinctly with this association.

The committee has met and discussed the matter, and it would like to know what the association is willing to authorize it to do in this connection. One thing which is sometimes done in tablets, is to cast the features of the deceased in bronze. Mr. Pickering seems to think that perhaps the monument might not be adaptable to such a tablet as we might wish to erect, and that a better arrangement perhaps would be to erect it on the lot over the grave and then, if we have money enough, we could perhaps consider the question of having the features of Mr. Patterson sculptured on the tablet. One member suggested that the tablet be in the form of the shield of the association.

It seems there will be no trouble in getting the necessary funds. A number have expressed a desire to contribute, some $5 and some $10 while practically every member would be willing to contribute a dollar or two. It is the opinion of the committee that this money should be raised by voluntary contributions rather than from the treasury of the association.

I understand his name would properly be inscribed upon the monument and there would be nothing but family remembrances of the Deacon, whereas a good many are desirous that there shall be some memorial which shall distinctly connect the Deacon with this association. The committee would like the sense of the association. I will therefore make a motion that it is the desire of the association that some form of permanent memorial be provided by voluntary contribution.

P. J. O'Neill:—I wish to support that motion, but I think it ought to be a part of the motion that the members not present should have an opportunity to contribute, by sending them notice in the Bulletin or otherwise.

W. M. Camp:—It was in the mind of the committee, that the members not present would be asked if they desired to contribute.

Mr. Camp accepted Mr. O'Neill's amendment to his original motion. The motion, as amended by Mr. O'Neill, was put to a vote by the president and carried.

The President:—I will appoint Messrs. Strouse, Hadwen and Montzheimer a committee of three to circulate among the members and carry out that portion of the motion which applies to the attendance here today.

The contributions were then taken and counted by the committee appointed by the president.

The President:—The next paper is on "Shipping Company Material Economically by Loading Cars to Capacity and Unloading and Releasing Them Promptly." This paper has been written by J. R. Pickering, superintendent of car service of the Rock Island, who is perhaps as well qualified as any man in the country to speak on that subject. In view of the demand of the Government at Washington that cars shall be fully loaded, it is up to the railroad men here to do their part in setting a good example to the public by loading their cars to capacity. In the absence of Mr. Pickering I will ask Mr. Howson to read that paper. (See paper and discussion.)

The President:—The next paper on the subject of "Bridge and Building Material Yards" is directly in line with the discussion of the preceding paper and in the absence of the author, H. C. Pearce, general purchasing agent of the Seaboard Air Line, I will ask the secretary to read the paper. (See paper and discussion.)

G. T. Richards also presented a paper giving the layout and the practice followed by the Chicago, Milwaukee & St. Paul at its extensive yard at Tomah, Wis. (See paper.)

The President:—I do not want to close this session without saying a few words, for it becomes necessary for me to leave Chicago after the banquet tonight for Kansas City on urgent business. I want to thank you all for the way in which you have paid attention and stuck to the business of the convention the last two days which has made it a grand success. I hope it will be my pleasure to meet with you from year to year as time goes on and continue our pleasant relations for I have a very warm spot in my heart for this association. (Applause.)

Meeting adjourned at 5:30 p. m.

MORNING SESSION

Thursday, Oct. 18, 1917.

The meeting was called to order by the first vice president, S. C. Tanner, at 9:45.

The Chairman:—If there is nothing else to come before the meeting at this time we will proceed to the election of officers for the ensuing year.

The secretary will again read the list of names given in the report of the nominating committee.

(The secretary read the list of names.)

G. W. Andrews moved that W. M. Camp be instructed to cast one ballot for the members present, electing as officers those who have been recommended by the committee.

Motion carried and vote cast.

The Secretary:—In the absence of the outgoing president we will ask G. W. Andrews, the oldest surviving past president to come forward and install the newly elected president.

G. W. Andrews:—Mr. Tanner (arising), in behalf of the members who have elected you I ask you to accept the office of president of this association.

(Mr. Tanner accepts.)

Gentlemen, it affords me a great deal of pleasure to introduce to you our newly elected president, S. C. Tanner. This is a pleasure in more ways than one. I have been associated with Mr. Tanner for a number of years. He now is occupying the position on the railroad which I once had the honor of holding and he is now to assume the position of the highest honor which can be bestowed by the members of this grand old association which likewise conferred the honor on your humble servant. If Mr. Tanner makes as good a president as he has made a master carpenter he will serve the association with honor.

The President:—Mr. Andrews and Gentlemen: I wish to thank you for conferring on me the honor of electing me to the highest office in this Association.

I will ask the other members present who were elected as officers to please rise and indicate their acceptance of the positions which they have been called upon to fill.

(The newly elected officers arose and accepted.)

C. W. Wright:—We have had a live worker in our organization in the last year in Mr. Smith, and he has filled the specifications in

every way. He is not present with us this morning, and we didn't get a chance to say anything to him, but I would now move you that we extend a vote of appreciation to Mr. Smith for his efficient and able services as president of this association for the past year.

The motion was duly seconded and carried.

The President:—The next item to be brought up for your action is the selection of the location for holding the 1918 convention.

Nominations are now in order.

The Secretary:—Before making the nominations for the next meeting place please permit me to make a few remarks based on the experiences of the year just passed. Many of those present may not know why the location was changed from St. Paul to Chicago. In the early part of the season, after several similar organizations had decided to abandon their annual meetings, the secretary received numerous letters from our members quite a few of which were favorable to the abandonment of our meeting for one year at least, while others suggested that we carry out the program as usual. Several of the prominent members in the vicinity of St. Paul recommended that we call the meeting off. The secretary wrote the members of the executive committee asking them if they would not favor a one day's session at least in some central location and thus keep the affairs of the association alive as it was observed that some other similar organizations were carrying out their conventions as in other years. The replies were nearly all favorable. The result was made known to the president, C. E. Smith, who called a meeting of the executive committee, at which meeting nine of the executive members were present. It was decided to revise the program and to substitute certain subjects that would interest all of our members, the discussion of which would accrue to the decided benefit of the railroads. Mr. Howson assisted the committee materially in all of its undertakings. The wisdom of the decision is left to the judgment of the association after seeing the results of this convention.

What I want to mention in particular is that for some time to come we must not forget to keep in mind the selection of a location where the hotel facilities will be ample to provide suitable accommodations for the attendance is increasing every year. When the location is determined we should be particular to select a hotel which will be able to provide a suitable convention hall. Several of our conventions have been held in halls where the noise actually ruined the effect of the sessions.

Now in nominating cities for our next meeting place I think

it would be wise to keep within range of easy transportation facilities. We ought not to consider places far out of the way at all. We might select a place like St. Paul which location could again be changed by action of the executive committee if war and other conditions made it necessary the same as was done this year. Personally I have no choice. I do not think it would be a mistake to go east next year if not too far.

B. F. Pickering:—I didn't expect to take any active part in the discussion of the question of our next year's meeting place, but some of the gentlemen behind me were going to poke me in the back and I had, for comfort's sake, to get up. (Laughter.)

I think we should take into consideration not only the matter of suitable hotel accommodations in selecting our place of meeting, but under present conditions in our country we should be exceedingly careful in selecting any definite place for the next year's meeting. I was quite amused at our secretary who said that we either ought to select some near-by point, such as St. Paul, or leave it in the hands of the executive committee. Now St. Paul may be a near-by point for Mr. Lichty, but not for Mr. Alexander. However, I quite agree with what our secretary said in regard to making any definite selection. I also think that in justice to St. Paul we should consider their claim very seriously. They have been trying to get us to St. Paul for some time, and this year in the early part of the season it didn't seem possible for us to get that far away, especially on account of the fact that the Government was needing practically all the passenger equipment and train service that the railways could afford through almost every region, and to go off to a point that is not as central perhaps as Chicago, seemed like quite an undertaking. It would overburden perhaps two or three roads, with the vast amount of Government business they are already required to do. Therefore, the selection of Chicago by the executive committee was a wise one, I think, under the conditions.

Now conditions may prevail similar to what they are at the present time next year, but they may also improve very radically. Therefore, I would move you that St. Paul be selected for our meeting place for the convention of 1918, with this provision, that if conditions are such as to make it inadvisable or inexpedient to meet there, on account of war conditions, the executive committee shall select some more central point, not necessarily, perhaps, Chicago, but some point where many railroads center, that the burden may be distributed in taking our members to and from, and also with the

consideration of the hotel accommodations. With that provision, I nominate St. Paul for our 1918 convention.

The nomination was seconded by A. S. Markley.

G. W. Andrews:—My view of the matter is the same as that expressed by Mr. Pickering. I feel that, in view of the fact that we had selected St. Paul for this year's convention, we ought to feel that we owe a duty to that city to recognize her rights in the matter, and if conditions have improved and the horrible responsibility that is now resting upon our shoulders is removed, we should go to St. Paul. The proviso of authorizing the executive committee to take final action is a good one. If conditions such as the present—and I am sure not only every man here, but every sober-minded man in the world hopes that the great war which is now raging over the face of the earth will be removed before that time—are past and we find we can go to St. Paul without question, let us go, but if not, the executive committee can select whatever in its good judgment may be the best place to meet the conditions existing at that time.

J. B. Sheldon:—The general impression of the members of this association seems to be that the selection of Chicago as a meeting place for this year was a good one, probably for various reasons, the principal of which is the transportation question, and, as was suggested by our secretary, it would probably be necessary, in the opinion of a good many, to hold the meeting at some central railroad location next year. The city of Chicago is claimed to be the greatest railroad center of this country,—very much the biggest. But there are other points. Take the city of New York. The headquarters of nearly all of the big railroads are in New York. Almost all of them are governed from there. We have never had a convention in the city of New York. We have probably as much or more to see there as elsewhere. We have more to see from an engineering standpoint, and from the standpoint of natural scenery than any other city in the United States. Around Manhattan Island is the greatest aggregation of people on earth. We have engineers, and they have not been idle. Their works are scattered all over Long Island. We have bridges galore, some of them excelled only perhaps by the one at Quebec.

We have hundreds of hotels. And if the hotels of New York are not able to take care of them at this time of the year there are a dozen or more steamboats tied up at the harbor of New York that are veritable palaces. For the reasons given I nominate the city of New York for the next convention.

C. W. Wright:—I would have been pleased to make that nomination myself but I knew Mr. Sheldon could make it much better. I rise to second that nomination. I don't think that the conditions that prevail in other cities are applicable to New York City. I don't think you will have any trouble with hotel accommodations in New York. In fact, the Merchants' Association of New York have promised us the best of accommodations.

Mr. Hadfield:—Mr. Smith told me he would ask that I be given a few seconds to speak about St. Louis. I think you ought to select a central point. I find in the central part of the country, in Chicago particularly, in the City of St. Louis equally so, we are having the maximum attendance. St. Louis and Chicago are both central, and I challenge the statement that we can't have as many members present in St. Louis as in Chicago. I claim it is just as central as Chicago. On the first week in November we will have our new Statler hotel. It will be opened within the next month. We have other hotels, adding altogether about 1500 new rooms, each with a bath, and those hotels are largely booking the conventions. Another thing,—we have some big bridges in St. Louis, and I want to announce that our free bridge is open and working and has been for a number of years. We will have the railroads running over there soon.

W. M. Camp:—We are making entirely too much of a fuss about the place of holding a meeting. Early in the year some of the railway associations, of which there are a good many, got fearful about this matter, and said, "I don't think we will have any attendance to amount to anything,—the railroads are going to be congested,—a lot of the conventions are being abandoned," and a lot more expressions along the same line, and yet, when the Railway Fuel Association met here it had the largest attendance in its history. Last year the Roadmasters had some misgivings about going down to New York. They had been holding all their meetings in Chicago and they were afraid to go down to New York, but they finally did go and they had the largest attendance in the history of their association. This year they came very nearly abandoning the convention, but by one majority in the executive committee they decided to hold it in Chicago and they had the largest attendance in their history, larger than at New York.

I don't think we ought to pay any attention to the bugaboo about small attendance and the lack of transportation facilities. When the railroads can carry thousands forth and back from New York to play baseball, why can't they carry the bridge and building men?

What is more important to the railroads and to this country than to get the railroad men together and have them consider emergency matters that have to be brought into force? If it should happen that a place should be selected and a year from now the railroads are congested with the hauling of troops and we can't go to that place, the executive committee has the power to change the place. I think we should go ahead and select a place of meeting just the same.

B. F. Pickering:—I move the nominations be closed and we proceed to ballot.

The motion was seconded by Mr. Weise.

The President:—It is moved by Mr. Pickering and seconded by Mr. Weise that the nominations be closed and that we proceed to ballot. The first nomination by Mr. Pickering was St. Paul, which was seconded by Mr. Andrews. The second nomination was by Mr. Sheldon for New York, which was seconded by Mr. Wright. Mr. Hadfield has given us a nice talk on St. Louis, and of course, we thank him for his welcome, and will take that city into consideration with the others.

The President appointed E. T. Howson, Lee Jutton and Chas. Ettinger as tellers.

E. T. Howson read the result of the ballot as follows: Cincinnati, 1; St. Louis, 6; St. Paul, 30; New York, 52.

The President:—Gentlemen, you have heard the result of the ballot. New York has the majority, and will be our meeting place for 1918 unless conditions should arise during the year which suggest a change of location.

We will now have the report of the committee on subjects for next year.

LIST OF SUBJECTS FOR 1918

1. Repairing and strengthening old masonry (continued).
2. Painting metal structures.
3. Water supply.
4. Labor saving equipment.
5. Small versus large gangs for maintenance work.
6. Shipping company material economically.
7. Bridge floors and guards.
8. Concrete.

F. E. Weise,
Chairman.

F. E. Weise:—I think that perhaps the committee on subjects made a mistake in not presenting a written report as we have in the past. We should have made clear that our list of subjects is very much shorter and briefer than is usually the case. We usually present a list of 11, 12 or 13 different subjects, figuring that one, two or three committees are going to fall down or that it will be impossible to get some committees to handle particular subjects during that year. This year we made the list very brief, including only subjects we thought would be of interest next year, with the intention of recommending to the association that the list be referred to the executive committee, with authority to make such changes as are necessary during the year and to add additional live subjects that would come up during the year, because we don't know what the developments of the near future are going to be.

At this juncture A. S. Markley recommended a subject concerning the handling of work during and after floods, and R. C. Sattley suggested one in connection with valuation work. After some discussion E. T. Howson offered a motion.

E. T. Howson:—Mr. Sattley has just made a suggestion for a subject and Mr. Markley has made another suggestion. There are two subjects up now. There are going to be other things develop during the year. Things move so rapidly that we can't tell now what are going to be the live topics a year from now, just as a year ago we didn't realize what would be the live topics of today. I would move that the report of the committee on subjects, and the suggestions that have been offered, be referred to the executive committee for early action at the same time that the appointment of the committee members is under consideration, and that the executive committee select those subjects which, in its estimation, are those that it would be best for the association to take up, leaving sufficient room for more subjects to be added next spring, when the association will have more definite ideas.

B. F. Pickering seconded this motion. (Motion carried.)

A. F. Miller:—It seems like there is one subject that has never been brought up before the convention, and that is the subject of re-enforced concrete buildings such as engine houses, coal chutes and water tanks. I think that is one of coming materials which we will all have to look to in the near future, and the sooner we get on that the better it will be.

The President:—It is now up to the executive committee to add subjects, or to make any changes it sees fit.

F. E. Weise:—May I say just a word on this matter of subjects? The committee on subjects—and I happen to have been on that committee for several years past—finds it a rather difficult matter to make up a list of subjects that will bring before the association the things the members want to know the most about, and also the things that will bring about discussions. We have had some subjects we thought were exceptionally good that have brought forth no discussion, and others that we didn't think of much consequence have unexpectedly brought forth a flow of discussion. It is rather hard to anticipate that.

It is also hard to know just the subjects the members are interested in. Time and again the secretary has asked for suggestions, but these suggestions come in very rarely. We will get two, three, four or maybe half a dozen suggestions from a membership of 700 or more. If more of the members would take an interest in this problem and write to the secretary during the year, it would help the committee on subjects. It would also help the secretary and the officers in feeling the pulse of the organization and I think much could be accomplished in that way.

The Secretary:—I wish to remind you that Mr. Phelps Johnson, president of the St. Lawrence Bridge Company, is a member of this association. When we have as important a personage in our association as Mr. Johnson is, he having completed a task which is world famed, in the erection of the Quebec bridge, I think we ought to recognize that honor and have it spread in the minutes of the association.

B. F. Pickering:—I think the point is very well taken. We all at least know something of the great undertaking Mr. Johnson has been through, and the many discouragements which he has encountered in the erection of the great Quebec bridge. Therefore, I move you that a message of congratulation be extended to Mr. Johnson on the success of his great undertaking, showing the appreciation of this association for one of its member's signal work.

This motion was duly seconded and unanimously carried.

The Secretary:—I would recommend that when we adjourn we visit the exhibits of the supply men in the adjoining room.

It occurs to me that this has been the best convention in our history, the attendance of members having reached 168. We have adopted a new plan this year of having the registration table outside, at the entrance of the hall where dues can be paid and where

the handling of badges, etc., was conducted. This is a move in the right direction.

The secretary has received valuable assistance from the members during the past year and desires hereby to express his gratitude. We trust that the good work of the association may continue.

J. P. Wood:—I would like to move you that this association extend by a rising vote of thanks its appreciation to the members in the city of Chicago for the able manner in which they arranged for this convention and the way it has been conducted.

The motion carried.

The Secretary:—You were not expecting, from what you were informed in the program, that you were going to receive much entertainment at this convention, but we think it resulted to the decided benefit of the association and the convention, because we have had the best attendance in our sessions in the meeting this year that we have ever had.

L. D. Hadwen:—There have been some years when there has been too much entertainment, and the entertainment which comes upon an intermediate day is always amiss, because when the convention adjourns a forenoon or an afternoon session for an entertainment of some kind it never gets the attendance back again. I believe in holding the business sessions continuously until the business is transacted. I think the committee on arrangements in this city has furnished ample entertainment at this convention.

P. J. O'Neill:—We come here for a specific purpose. Many of the railroads are paying the expenses of the members and they are all allowing the time of their employees who come here. I don't think it is a fair deal to the companies we represent for us to come here to a convention and then spend the time in enjoyment for ourselves. We ought not to do it. We ought to be in this convention hall during all the business meetings of the convention.

J. S. Robinson:—I would like to move that the Supply Men be given a vote of appreciation for the splendid entertainment they have given us.

The motion carried.

REPORT OF THE COMMITTEE ON RESOLUTIONS

Chicago, Oct. 18, 1917.

Resolved:—That the thanks of the Association be extended to the following individuals and corporations:

To the American Bridge Company for furnishing guides and conducting our members through its plant at Gary:

To the New York Central for special service and transportation to and from Gary:

To Sears, Roebuck & Co. for luncheon served our ladies, together with a trip through their plant:

To the Bridge and Building Supply Men's Association for the fine exhibits and for the many courtesies shown our members and their families with special mention of the annual dinner:

To Albert Reichman, O. P. M. Goss, H. C. Pearce and J. R. Pickering for their instructive and helpful papers which are valuable assets to our proceedings:

To the Pullman Company for extending half rates to our members and their families en route to and from our convention:

To the press and the technical journals and their representatives for reporting our convention:

To the officers and the members of the various Committees who so generously contributed their time and efforts to make our work a success.

Be it further Resolved:—that these resolutions be spread on our record and the secretary instructed to forward a copy to all parties interested.

Respectfully submitted,

B. F. Pickering,
Lee Jutton,
L. D. Hadwen,
Committee.

The President:—The next in order is adjournment, but before we adjourn I wish to congratulate you all for the fine attendance I have noticed in the present meeting. I also wish to take this opportunity to ask you to bring as many as you can next year and swell the attendance and to do everything possible in the meantime to make the work of this association a success.

We will now adjourn to meet in New York City the third Tuesday in October, 1918, unless conditions require a change of location.

It is so ordered.

L. W. Hoskins,
Reporter.

C. A. Lichty,
Secretary.

MEMOIRS

SAMUEL F. PATTERSON

During the year one of the corner stones in the membership structure of the association has been lost in the death of "Deacon" Patterson. He passed away at Chicago, on April 17, 1917. While traveling from Florida, where he had spent several weeks, to visit friends at River Falls, Wis., he was stricken with ptomaine poisoning and went to a hotel, thinking that his illness was slight; but upon the advice of a physician was taken to the Wesley Memorial hospital, where pneumonia developed and death resulted in about two days.

Samuel Folsom Patterson was born in Contoocook, N. H., January 23, 1840, of Scotch descent, three generations of the family before him

Samuel F. Patterson

having lived in America. His grandfather on the paternal side, Alexander Patterson, was a soldier of the Revolutionary war, in Col. John Stark's regiment, and was wounded in the battle of Bunker Hill. From this ancestor the family tree has been traced back to John Patterson, who was born in Argyleshire, Scotland, about 1640.

Our lamented friend, the "Deacon," began his railroad career as a bridge builder on the Concord & Montreal R. R., before the Civil War, and, except for an intermission during the war, remained in the service of that company, and of its successor, the Boston & Maine R. R., more than 50 years. He was made superintendent of bridges and buildings in 1883, and a few years ago retired from active railroad service on a pension.

He enlisted as a private, in Co. B, 2nd New Hampshire Volunteer Infantry, Sept. 7, 1861, and served the full enlistment of three years. After re-enlistment, in 1865, he was appointed first lieutenant in Co. C in the same regiment. He fought at Seven Pines, Gettysburg and other battles.

Mr. Patterson joined the Association of Railway Superintendents of Bridges and Buildings, at Cincinnati, Ohio, in 1892. At that meeting he was elected secretary of the association and served in that capacity continuously for 17 years, or until 1909. He then, at his own request. was relieved of the active duties of the office, and, by general acclamation, was elected secretary emeritus. While, owing to advancing age, he felt obliged to decline re-election as secretary, at the time stated, he has, nevertheless, attended all of the annual conventions since that time and maintained active interest in the work.

It is fitting here to say that he was not only one of the most popular, but one of the most useful and beloved of men connected with railway association work. He brought to his office a ripe experience as a bridge and building engineer, and his administration of it was always highly efficient. He was the right man in the right place; and it ought to be added that it was largely owing to his practical knowledge of this department of railway work and his untiring efforts, that the association was so well organized in its early years and so strongly upbuilt as time went on.

Owing to his quiet demeanor and ministerial appearance he was familiarly known to his railroad and association friends as "The Deacon"; in fact, this termn of endearment was inseparable from his name. A man of intelligence, most diligent in his business; a great worker in the cause of engineering education; successful, admired, and loved by all, was "Deacon" Patterson.

[At the annual convention, Tuesday evening, Oct. 16, 1917, was set apart specially to memorialize Mr. Patterson. The meeting was well attended, and upwards of twenty members, in short addresses, expressed their appreciation of the life and services of the "Deacon." These addresses were taken down stenographically and with letters from other members not present, will be published in a more complete biography of Mr. Patterson, to be issued as a separate volume by the association.]

CHARLES G. CONNOLLY

Charles G. Connolly, for many years general foreman of bridges and buildings for the Delaware, Lackawanna & Western Railroad, was struck by an engine on the morning of October 21st, 1916. The accident resulted in a serious fracture of the skull and Mr. Connolly lived but a few hours.

He was born in Honesdale, Pa., in 1865, and learned his trade in that town. He entered the employ of the Lackawanna in the bridge and building department in 1888, and spent the remaining years of his life in that department. In 1898 he was promoted to foreman and in 1904 to the position of general foreman, being assigned to the Bloomsburg division. In 1908 he was made general foreman in charge of the construction of new shops at Scranton, Pa., and from there was transferred to what is known as the Jersey Cut-Off for a short time. In 1912 he was again transferred, this time to the Buffalo division, where he held the position of general foreman until the time of his death.

Mr. Connolly was a very strong character and a man of marked ability. While he was slow to make friends, once a friendship was established it was rarely, if ever, broken. He was connected with many of the large and important pieces of work done by the Lackawanna in the last 20 years and many of the improvements along the line will long stand as a monument to his ability.

He was a brother of John J. Connolly of Honesdale, Pa., Dr. Albert Connolly of Buffalo, N. Y., and the late Rev. William Connolly of Hazelton, Pa. He was also survived by his wife, Mrs. Ella McKeever Connolly.

WILLIAM M. CLARK

William M. Clark was born at Centerville, Pa., on April 13, 1852, and died January 1, 1917, three miles east of Wheeling, W. Va., one-half hour after being struck by an express train. At the time of his death he was on an inspection trip preparatory to the strengthening of the bridges on the Wheeling division to compensate for the increased weight of locomotives and rolling stock. Mr. Clark was in the employ of the Baltimore & Ohio for 35 years, and was a veteran of the old Pittsburgh & Western railroad, having been engaged in building the first bridges and trestles on the latter road. The last 8 years prior to his death he was master carpenter of the Pittsburgh division of the Baltimore & Ohio with headquarters at Pittsburgh.

William M. Clark

Mr. Clark was a member of the Hazlewood Presbyterian Church; he was also a Knight Templar, 32nd degree Mason, a Shriner, an Odd Fellow, and a member of the Royal Arcanum.

He leaves a widow, Alice Coulter Clark, one son and five daughters.

Mr. Clark joined the American Railway Bridge and Building Association at the Detroit convention in 1899, and was a faithful attendant at the meetings—always taking an active interest in the discussions. He attended the New Orleans convention only a couple months prior to his death.

JAMES VAUGHAN

James Vaughn was born at Piqua, Ohio, in 1856, and moved to St. Joseph, Mo., when four years old. He began work with the St. Joseph & Grand Island in 1874 as a helper in the bridge department. In 1877 he entered the service of the Chicago, Burlington & Quincy, and ten years later joined the forces of the Denver and Rio Grande. He was appointed supervisor of bridges and buildings on the latter road in 1898.

Mr. Vaughan died suddenly of apoplexy while on an inspection trip March 11, 1917. He was a resourceful man who made good when conditions were difficult and facilities poor, and was respected by his subordinates and superior officers. He joined the association at its 20th annual meeting in Denver in 1910.

ROBERT JOHN M'KEE

Robert John McKee was born at Pittsburgh, Pa., on March 12, 1861, and died at the St. Francis Hospital, Freeport, Ill., on June 9, 1917, of injuries resulting from being run down by an Illinois Central switch engine while on duty.

From an early date he was associated with construction work, starting as a bridgeman on the Iowa Central Railroad in the spring of 1880, and being promoted to foreman on this road in 1886. After eight years' service in that capacity, with the Iowa Central, he came to Chicago as bridge foreman for the Illinois Central. On July 25, 1895, he was promoted to the office of bridge supervisor of the Springfield division with headquarters at Clinton, Ill. In 1906 he was transferred to the St. Louis division as supervisor of bridges with headquarters at Carbondale, Ill.

Robert John McKee

In 1908 he was transferred to the Freeport division as supervisor of bridges, which position he was holding at the time of his death.

He was a man of noble character and strong personalities, and was much esteemed by all who knew him. His big-heartedness and kindness won him many friends.

Mr. McKee was married to Miss Lucy Draper of Brighton, Iowa, in 1887. He is survived by his wife and four children, Mrs. Gladys Baughman, Freeport, Ill.; Mrs. Ocean Hampsher, Washington, Iowa; Mrs. Martha Stout, and Robert J. McKee, Jr., Chicago, Ill.

Mr. McKee was a Knights Templar Mason, being a Past Eminent Commander of Clinton Commandery No. 66, Clinton, Ill., also a member of the American Railway Bridge and Building Association, joining at Quebec on October 20, 1903.

The funeral services were held at the home and were in charge of the Knights Templar Masons of Freeport, Illinois. Interment was made in Hillcrest Cemetery, Brighton, Iowa.

WALTER GASKIN

Walter Gaskin was born in Marysville, California, on July 15th, 1865, and died in the Southern Pacific hospital, San Francisco, on August 29th, 1917, at the age of 52 years, after an illness of several months' duration. He was buried from his residence in Los Angeles. He is survived by his wife and one son.

Walter Gaskin

Mr. Gaskin began his railroad service at the age of 19 years, filling the position as blacksmith with the Central Pacific railroad, now a part of the Southern Pacific System, and with the exception of about six years he has been continuously in the service of the Southern Pacific Company. In July, 1906, he was appointed scale inspector for the Southern district, which position he held at the time of his death. He was a man of sterling character; his genial disposition made him the friend of every one and made every one his friend.

Mr. Gaskin joined the association in 1913.

JOSHUA McMAHON

Joshua McMahon came to his death suddenly Nov. 18, 1917, at Coburg, Ontario, from heart failure caused probably by over-exertion in propelling a one-man velocipede from Port Hope to Coburg, where he went to oversee some work in connection with the construction of a new depot at the ferry dock.

He was in his 58th year and had been connected with the Grand Trunk for 33 years. He was one of Port Hope's most esteemed citizens, a kind and sympathetic neighbor and a friend as true as steel. He was a past master of Hope Masonic Lodge and a very active worker in masonry.

Mr. McMahon joined the American Railway Bridge and Building Association at its 23rd annual convention at Montreal in 1913. In addition to his widow he is survived by two sons and four daughters.

THE ERECTION OF PLATE GIRDER SPANS WITH THE LEAST INTERRUPTION TO TRAFFIC

REPORT OF COMMITTEE

It has often been said that the product of railroads is transportation. It has been impressed upon all railroad men that this fundamental principle should always be kept in mind and that they should work for a single purpose of producing transportation in as efficient a manner as possible.

Every railroad man should be interested in the work of his department. In the motive power department every employe should be interested in maintaining locomotives at the highest possible standard for the lowest cost. In the track department every employe should be interested in maintaining the track to the best of his ability. The employes of the accounting department are interested in keeping good accounts and records and in turning out correct statements. This same reasoning can be followed through all the various departments. The employes of each department, while interested primarily in their particular work, should remember that the single purpose of the railroad is to move passengers and freight from one point to another.

The bridge department must keep this fundamental principle in mind at all times in carrying out its work. All bridge work must be planned so as to interrupt traffic as little as possible, remembering that, when trains are stopped on account of a bridge not being ready, a portion of the plant is shut down and the output is stopped until the trains are allowed to proceed. In some cases there is traffic both on and under a bridge which may be under construction. This occurs when a railroad crosses over another railroad, a navigable stream, a busy street or a highway. The problem of maintaining two sources of traffic is often met in the construction of railroad bridges, and of course is more difficult than that of maintaining traffic only over the bridge.

In the erection of railroad bridges under traffic one of two general methods must be selected for each particular case. The old bridge must be taken out in small portions and the new bridge erected in the same manner, or the old bridge must be taken out and the new one put in by handling an entire span in one operation. The first method is most always selected when the traffic over the bridge is quite heavy, making it impracticable to suspend traffic long enough to permit the taking out of an entire span.

There are times, however, when this method cannot be followed even in the case of large structures and on heavy traffic lines. We refer to bridges over navigable streams or over busy railroad tracks. In such cases falsework cannot be put in for the erection of the bridges in sections and some method must be found to put in an entire span at one operation. When bridges are erected by putting in a portion of a span at a time it is necessary to provide a rather large amount of falsework and to arrange this falsework so that the work of changing from the old bridge to the new can be stopped at any point in order to let trains over.

In arranging falsework of this kind it is generally desirable to have

the bents in two sections. The lower section should be constructed so as to support a system of sub-stringers. These should be low enough to clear the lower chords of both the old and the new bridges. The upper section should be constructed so as to be inside of the trusses or girders and to carry the track during the removal of the old bridge and the erection of the new. A good example of the erection of a through plate girder bridge in this way is Fig. 3. This is C. M. & St. P. bridge Z754. In connection with this work the track was raised about 6 ft. 6 in. And this raising of the track was the first work done. The falsework was then put in and all of the blocking removed from the old piers, which left them free for remodeling to suit the new conditions. The falsework provided for a support under each floor beam. This permitted the removal of the old girders and the erection of the new, after which the new floor system was installed gradually as traffic permitted. It was possible at all times to stop work and close the track when necessary to let a train over.

The method of putting in a bridge by changing out one entire span at a time is usually selected when traffic conditions are not severe. It has the great advantage of requiring little or no falsework. As has been mentioned above, however, this method must be used no matter what the traffic conditions are when it is impossible to put in falsework such as over busy navigable streams or railroads. Almost always the new span is assembled and riveted alongside the span it is to replace. This necessitates the erection of one falsework bent at the end of each pier and abutment to receive the new span in its temporary position. This is usually put on the down stream side, although if local conditions require it may be put on the up stream side. Almost always the ties and rails are put on the new span in its temporary position so as to avoid doing that work after the span is moved into its permanent position. Before the new span is moved it is, of course, necessary to dispose of the old span. If time will permit the best method is to cut the old span apart and lift it out with a derrick car. If, however, time will not permit, falsework bents must be erected on the opposite side of the piers and abutments from the new span so that the old span can be moved out to one side preliminary to the moving in of the new span. If the weight of the new span and the capacity of the derrick will permit, the new span should be assembled on the ground at the end of the bridge and then carried bodily into place. The old span, of course, can be removed in the same way. When conditions will permit this method of erection no falsework of any kind is needed.

Fig. 1, showing bridge Z100, of the C. M. & St. P. Ry., illustrates the reconstruction of a deck plate girder structure in which six old spans were combined into three spans for a new bridge. Three new and heavier spans were provided to take the place of the three spans removed. Where the new spans were placed it was necessary to cut down the masonry as the new spans were deeper than the old. The work was carried out by erecting the new spans at one side and by sliding out the old and sliding in the new spans. As shown on the drawing very little falsework was required. This bridge is on a very busy line and there was practically no interruption to traffic.

Fig. 2 shows a method of putting in a double track concrete slab bridge, replacing a timber trestle. The slabs were constructed at one side and were moved into place, one track at a time. These slabs were about 13 ft. by 4 ft. by 36 ft., and weighed 100 tons.

Fig. 4 is a general plan for the erection of deck plate girder spans with ballasted slab floors. This is the usual method of sliding in from one side. The drawing illustrates the use of roller carriages such as are necessary when the span is too heavy to slide on greased rails.

Fig. 5 shows a method of reconstruction of bridge No. 10, on the Detroit division, of the New York Central. At this bridge through plate girder spans replaced a timber trestle. They were erected at one

side and slid into place on greased rails. This is a double track structure and the superstructure for each track is independent of the other track. The superstructure for each track was erected on the side nearest the track in which it was to be used and was moved in from that side.

The erection of bridge No. 142, on the Dakota division, of the C. & N. W. is shown by Fig. 6. In this case a deck riveted span on pile piers was replaced with deck plate girder spans on concrete piers. The girder spans were riveted up on temporary bents on the down stream side of the bridge. When everything was ready the old deck trusses were cut apart, moved up stream and lashed to timbers bolted onto the old pile piers for that purpose. The new spans were then moved into their permanent positions. The time between trains was sufficient to carry out this work without delay to traffic.

Fig. 7 shows a bridge used as an overcrossing of another railroad. In rebuilding this structure it was necessary to maintain the proper clearance for trains on the track below. In maintaining this clearance it was rather difficult to provide bracing for the falsework bents. It was necessary to put in one falsework bent as close as possible to the lower track; then put in the footing of the concrete abutment after which the falsework was completed by erecting a bent on the concrete footing. The superstructure is yet to be erected. This new superstructure is to be a 76 ft. 4 in. through plate girder span. The old bridge is a 44 ft. 3 in. through plate girder span with pile bridge approaches. The new girders will be set on the abutments outside of the old girders. The old span will then be taken out; the new girders moved sideways into their permanent position and the new floor system placed. It will be necessary to interrupt traffic much longer here than would be the case if it were possible to put in falsework under the bridge.

Fig. 8 illustrates a method used at bridge N. 896, on the Peninsula Division of the C. & N. W. Ry. The old bridge consists of deck Howe trusses with pile approaches. The new bridge is a three span deck plate girder structure on concrete piers and abutments. In order to erect the concrete piers it was necessary to cut off the ends of the Howe truss; falsework was arranged to do this. The new spans were put in by removing enough of the old bridge and falsework to permit the erection of one entire span. This was repeated for the three spans.

Fig. 9 shows the method of erection of bridge No. 737, on the Peninsula Division of the C. & N. W. The old bridge consisted of deck riveted span with pile bridge approaches and was replaced with three deck plate girder spans on concrete piers and abutments. Since the new concrete piers came within the limit of the deck trusses it was necessary to arrange the falsework so as to take down the old trusses and to provide space for the construction of the piers. This necessitated the use of two section falsework, the upper part of the lower section being just below the bottom part of the truss spans. This is a double track structure and it was possible to remove the falsework and set one span in place at a time without any severe delays to traffic.

Fig. 10 shows erection of bridge No. B8, on the Eastern division of the C. & N. W. The old bridge consisted of about fifty 60-ft. pony Howe truss spans on pile and frame bent piers. The Howe truss spans were replaced with deck plate girder spans of the same length. The base of rail was raised 3 ft. and the frame bents were cut down to accommodate the new spans. Work was carried out without any falsework whatever. The frame bent piers were cut down to the proper elevation for the new bridge and the Howe trusses were raised at the same time so as to bring the base of rail up to the new elevation. The crew doing this work kept several spans ahead of the crew putting in the girders. Preliminary to putting in a span of girders the stringers and ties on the Howe span to be replaced were removed. The temporary blocking was then taken from under the Howe truss span and the span

lowered onto the new caps. This brought the floor beam of the Howe truss below the lower flanges of the new girders. The floor beams, in this position, afforded first class staging for the men to work on. A span could be changed out in this manner in from two to three hours and the traffic was such that the work could be done without any delay to trains.

Fig. 11 illustrates the erection of bridge No. 259, on the Fort Wayne line. At this bridge a through plate girder span was replaced with a heavier span of the same type. It is a double track structure. The old bridge had three girders to a span whereas the new bridge has only two. The new span was erected complete at one side and when all was ready the old span was removed and the new span put in. Temporary bents were erected on each side of the piers and abutments for this work.

Figs. 14 to 19 inclusive illustrate the erection of a double track through plate girder bridge over a very busy system of railway tracks. This bridge carries the Lackawanna over the Nickel Plate, the Pennsylvania, and the Buffalo Creek Railway. On the three tracks under this bridge there is an average of six train movements per hour. It was therefore necessary to handle these girders from the tracks above. They are 106 ft. long and weigh 103 tons each. It was decided to take the girders off the cars on the approach and run them up endways to their position. The old crossing was at grade and a falsework bridge had been constructed over the entire space to be occupied by the new fill and the new bridge. This falsework bridge was for the purpose of making the fill on the approaches and for the erection of the girders. A set of light girders was used to span the main tracks. A temporary track was constructed along side the filling trestle on one of the approaches. This track was placed at such a height that the girders could be lifted from the cars to the filling trestle. Fig. 14 shows a girder ready to be lifted from the cars. Fig. 15 shows one of the girders after being placed on the filling trestle and ready for movement endwise. Fig. 17 shows the end of one of the girders after it came over the main tracks. Fig. 18 shows one of the girders just before it was placed in its permanent position. Fig. 19 shows the completed bridge. It will be noted that the temporary girders are lashed to the permanent girders to be removed later. These pictures illustrate a rather difficult job which was carried out with very little delay to traffic. It was necessary to set the temporary girders in place from the tracks below and there was some slight delay to traffic in doing this. Otherwise the traffic was not interfered with.

Bridge 160 on the Fitchburg division of the Boston & Maine was rebuilt in 1915 and 1916. This is a double track structure. The old bridge consists of three deck pin trusses and three plate girders. It was rebuilt as three spans of riveted trusses and three spans of deck plate girders. The new bridge was erected on the down stream side. Falsework was placed at the ends of the piers both up stream and down stream. When the erection was completed hoisting engines were placed on the new spans and lines were run from the drums in various directions for the proper movement of the spans. These lines were attached to the up stream side of the piers. The actual time consumed in moving the spans was six minutes. Five spans were put in at one time in this manner. It was necessary to break the tracks for a period of five hours in order to change the track centers from 12 ft. to 13 ft. and for other work in connection with the change in the type of bridge. The sixth span was placed later by a derrick.

When through truss spans are replaced with deck plate girder spans it is almost always possible to set the girder spans inside of the truss spans by cutting down the masonry and removing the lower laterals and floor system of the truss spans. Under proper conditions the girders can be lowered with rigging suspended from the top chords of the old

trusses. This is a very economical method of erection but it can be used only on lines where the traffic is comparatively light. A good example of this method is shown by Figs. 12 and 13, of bridge No. 134 on the Missouri division of the C. R. I. & P. These photographs show the heavier spans being placed by a derrick at either end. The shorter spans, however, were placed by suspending them from the top chords of the old trusses. On the W. & L. E. several through trusses were replaced with deck plate girder spans. A new concrete pier was constructed under the truss span and in most cases the old abutments were remodeled to receive the new girder spans. A specially-arranged derrick car was used in this work. Before the erection of the girders the rivets were removed from the floor system and traffic was carried on bolts. Just before removing the floor system it was necessary to cut the stringers over the new piers by the use of an acetylene torch. The end of the stringers at this cut which were not removed first were blocked up on the pier, after which enough of the floor system was removed and dropped below to permit the erection of one girder span. This span was finished, traffic resumed, and at an opportune time the second girder was erected in much the same way. This left the old span with the lower laterals, floor system and most of upper lateral removed. It was therefore necessary to support the trusses laterally by timber frames securely bolted to the under side of the girder span and extending up on the outside of the old trusses. These frames also furnished the necessary supports for dismantling the old trusses. In doing this work the track was closed to traffic from 1½ to 2 hours. This work is described in detail in Engineering News, Vol. 73, page 491.

We have endeavored to outline the general methods for the erection of plate girder spans with the least interruption to traffic. We have also called attention to specific cases. While one of the general methods can be applied to each bridge erection job, it is necessary to study each case separately and modify the general scheme to fit each individual case.

Lee Jutton (Chairman).
C. W. Wright.
J. S. Huntoon.
J. G. Bock.
C. U. Smith.
S. T. Corey.

Committee.

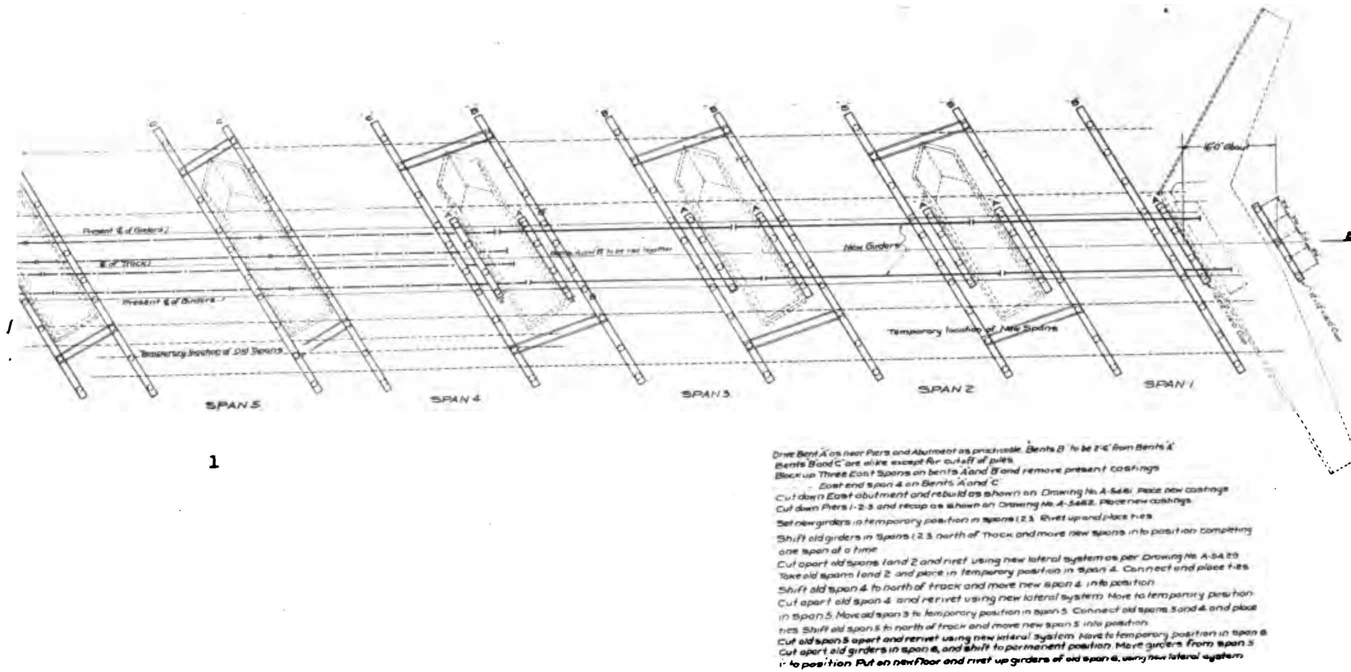


Fig. 1. Bridge Z-100. Chicago, Milwaukee & St. Paul Ry.

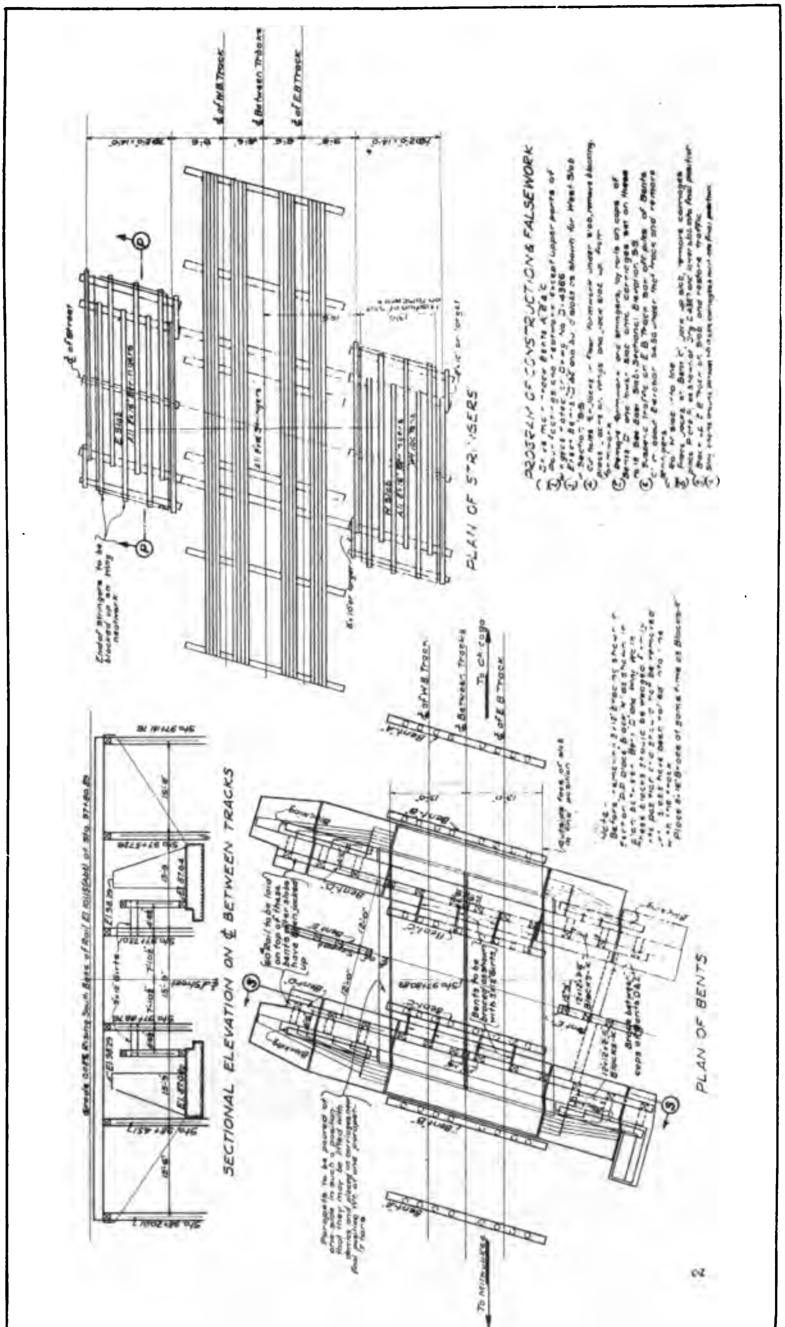


Fig. 2. Bridge A-118 2-3, Chicago, Milwaukee & St. Paul Ry.

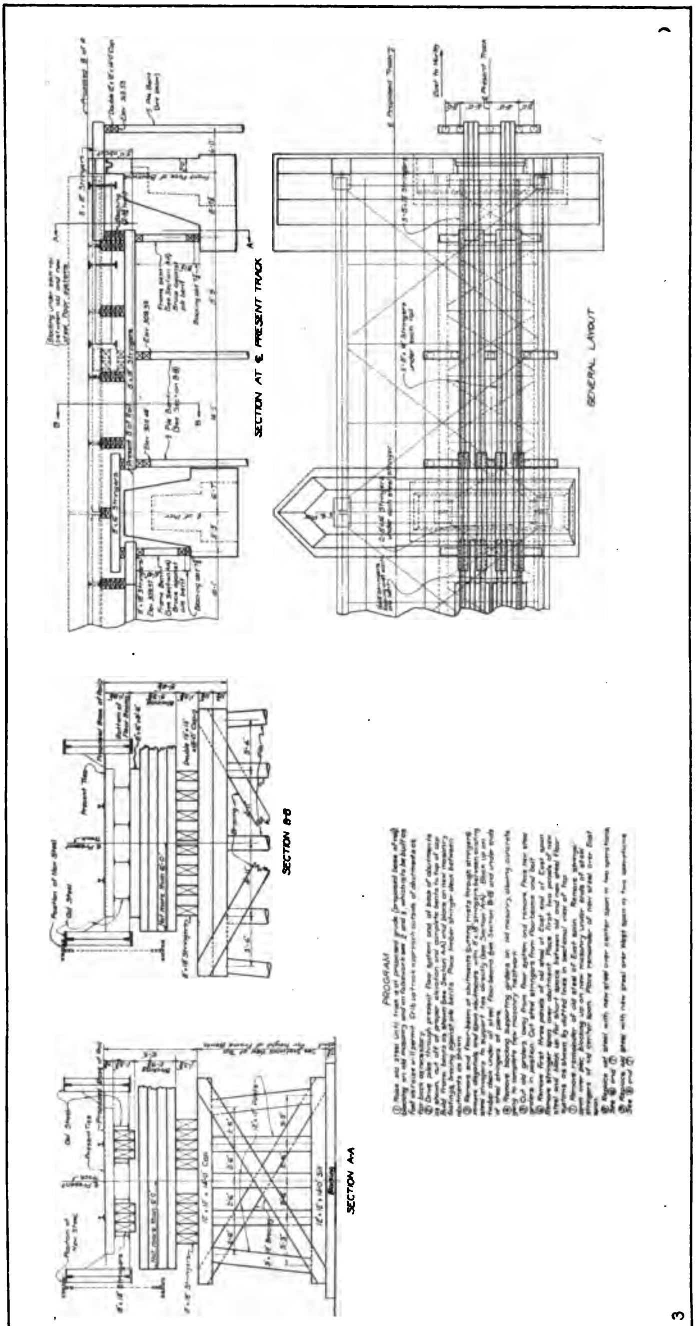


Fig. 3. Bridge Z-754, Chicago, Milwaukee & St. Paul Ry.

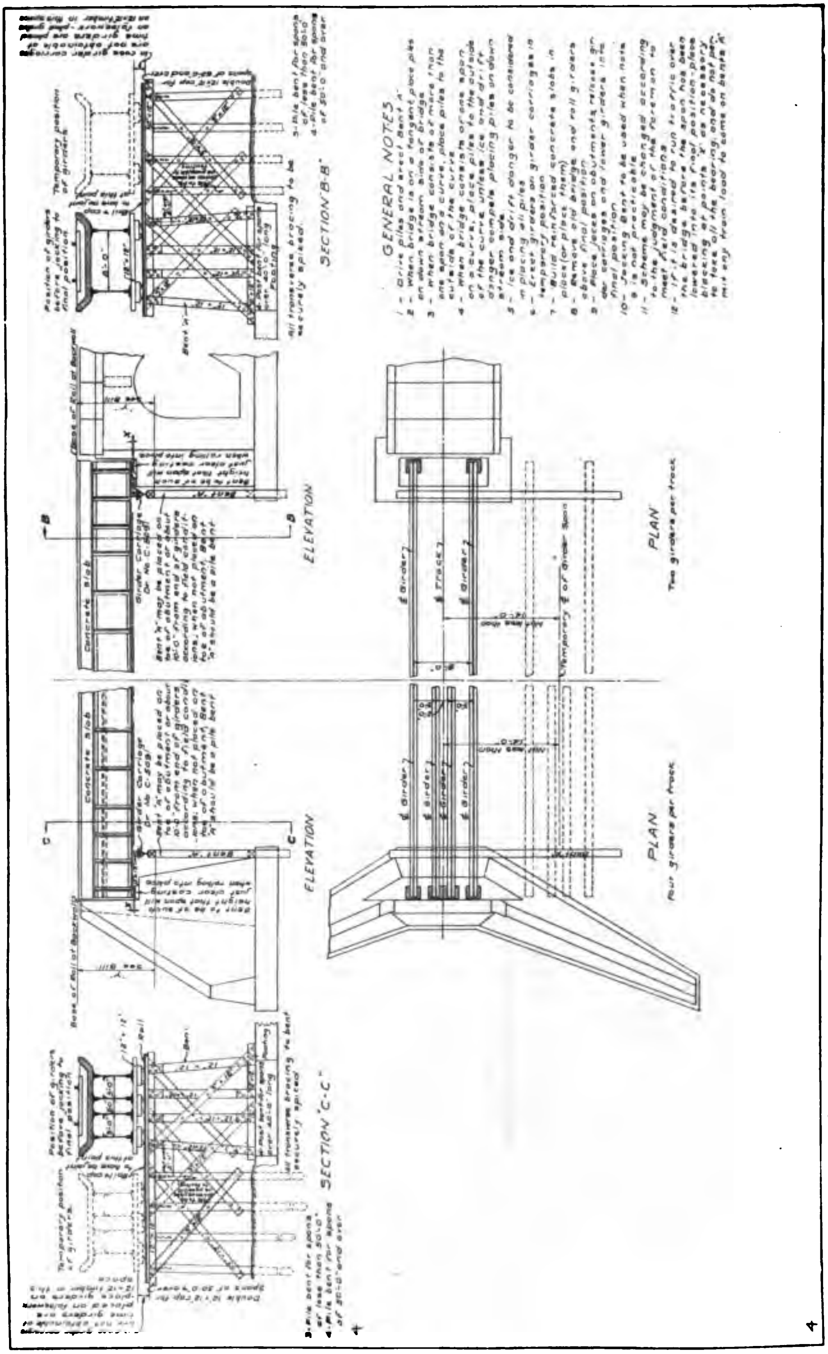


Fig. 4. General Erection Plan, for Ballast Floor Deck Plate Girders, C. M. & St. P. Ry.

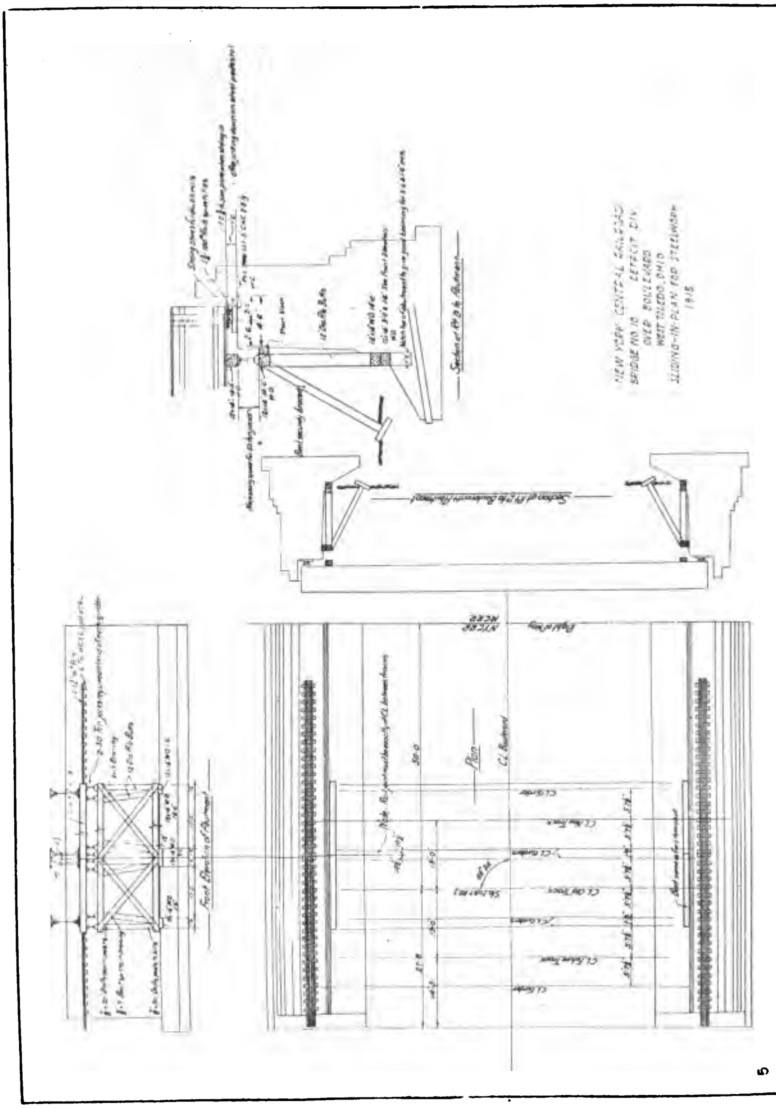
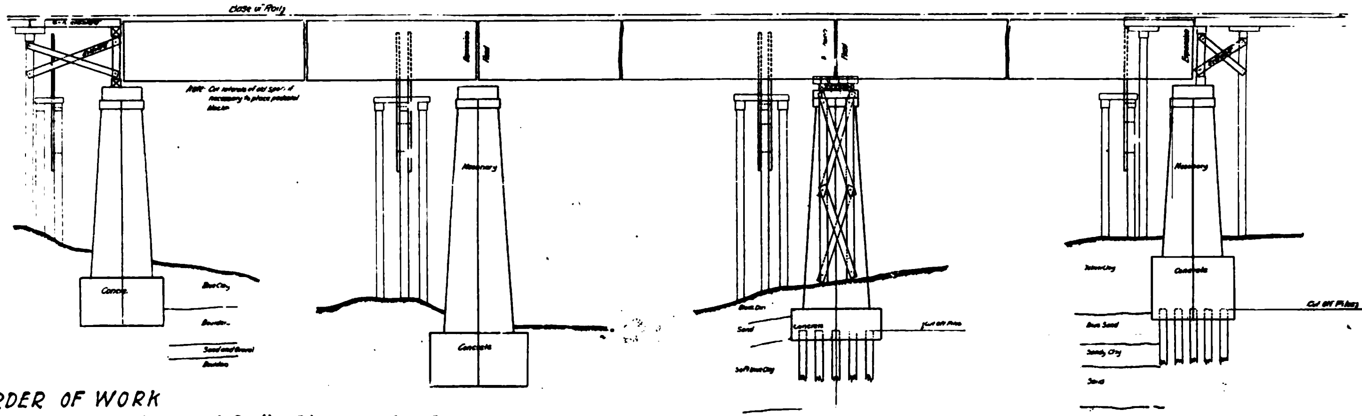


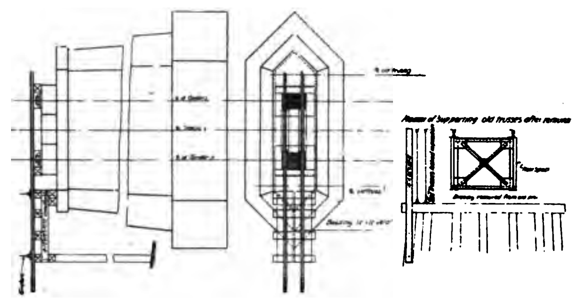
Fig. 5. Bridge No. 10, Detroit Division. New York Central Lines West



ORDER OF WORK

This Falsework is designed for the following order of work.

1 Build masonry piers
2. Drive pile bent at end of each pier and place crossbeams
3 Support all girders on crossbeams opposite their final positions and rivet up all connections Place cast bases on pedestal blocks
4 Remove old floor of end span, cut old trusses apart, and place them side by side on far ends of old piers, lashing them upright to 4"x 10' pieces as shown.
5 Jack up girders and place blocking and rails under them, spiking rails to blocking Slide girders into place
6 Connect new span and pile approach as shown, using one of the two permanent pony bents Connect new span and adjoining old span, using temporary bent and second permanent, as shown
7 Replace each span in this way, leaving permanent pony bent or last pier to support connection with pile approach.



MASONRY AND FALSEWORK PLAN OF C.& N-W. Ry Co's BRIDGE No 142
OVER THE JAMES RIVER - ¾ MILE EAST OF HURON SO DAK

Fig. 6. Bridge No. 142, Dakota Division, Chicago & Northwestern Ry.

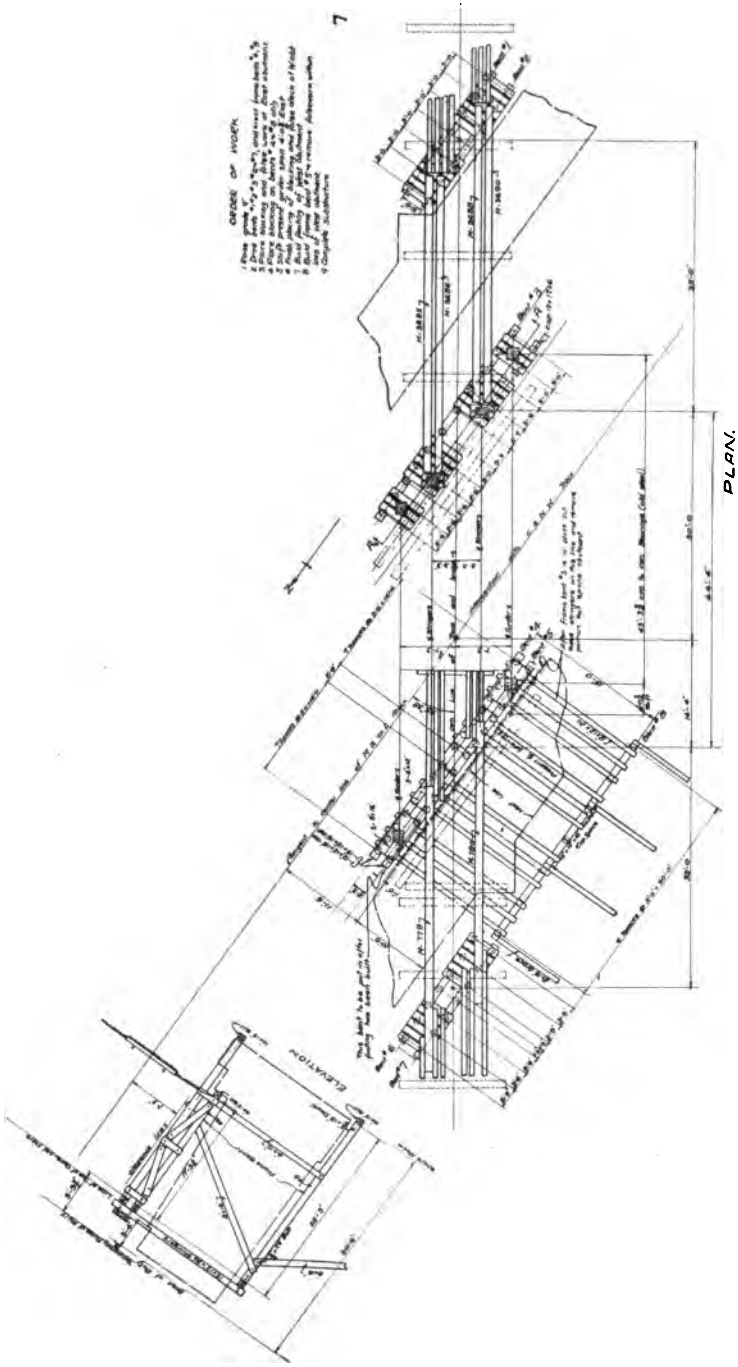


Fig. 7. Bridge No. 343, Northern Iowa Division, Chicago & Northwestern Ry.

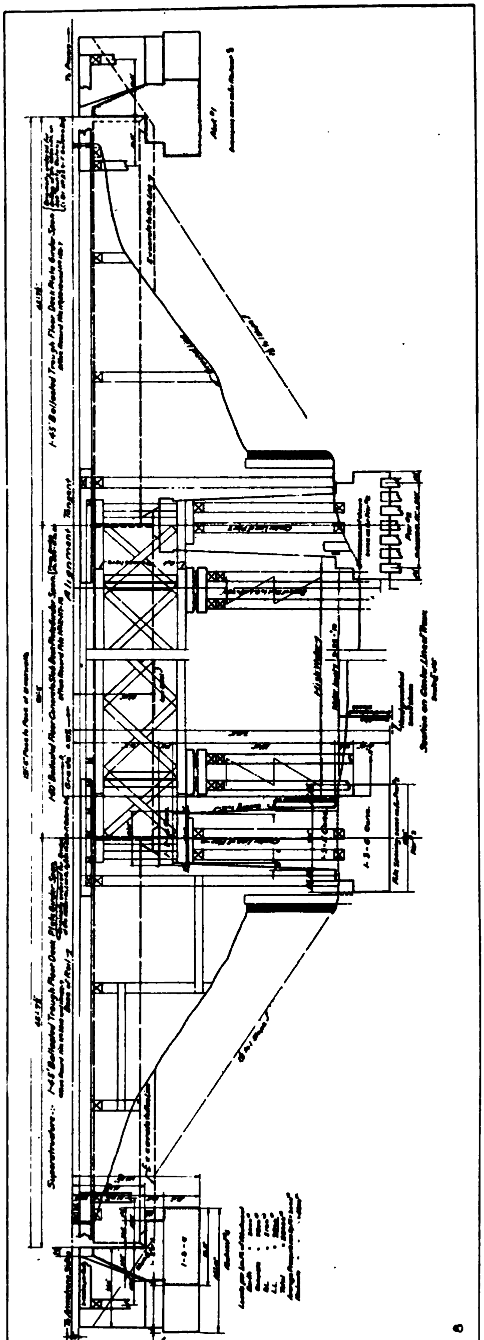


Fig. 8. Bridge No. 896, Peninsula Division, Chicago & Northwestern Ry.

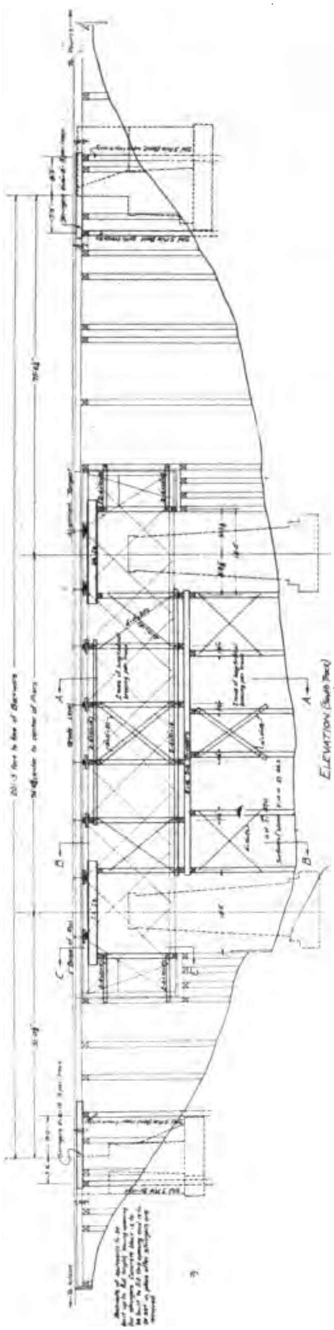


Fig. 9. Bridge No. 737, Peninsula Division, Chicago & Northwestern Ry.

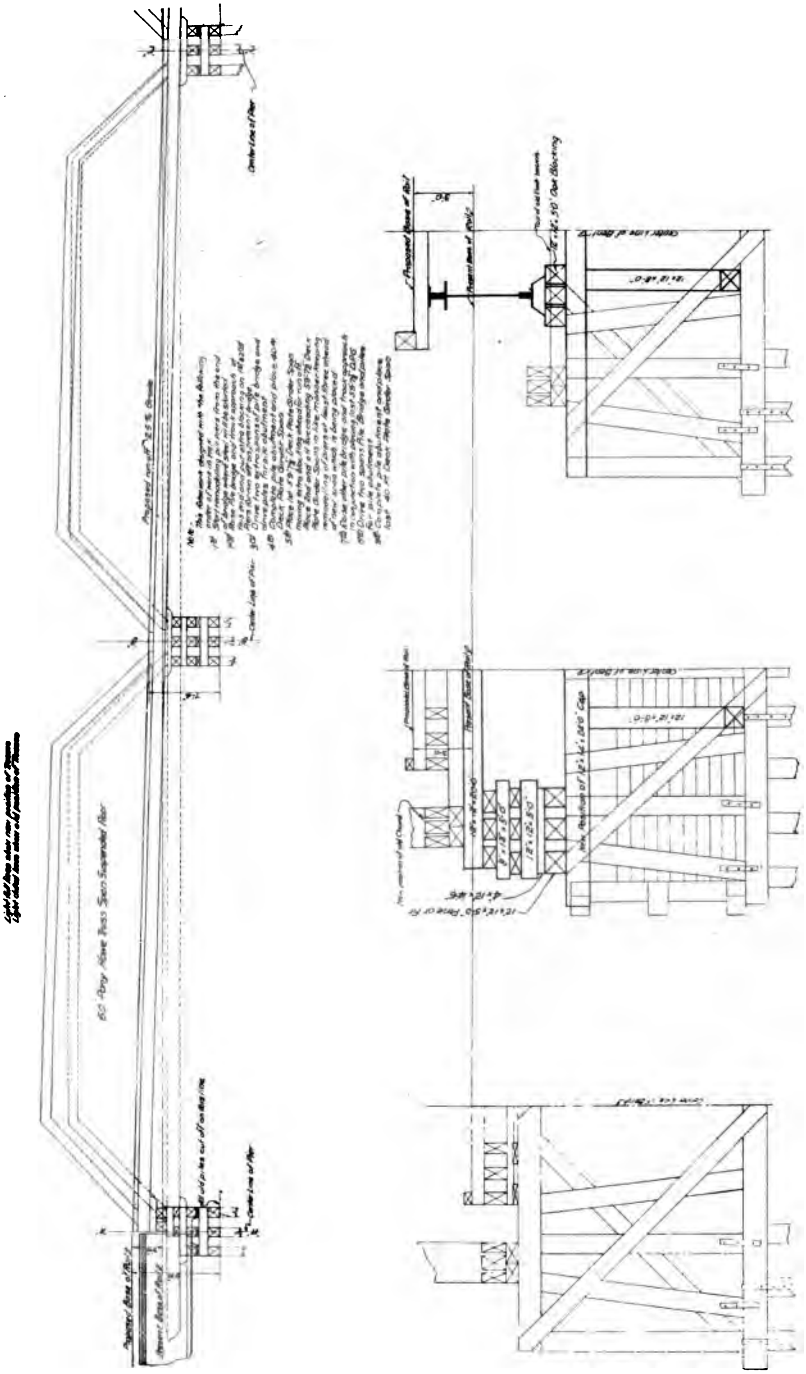
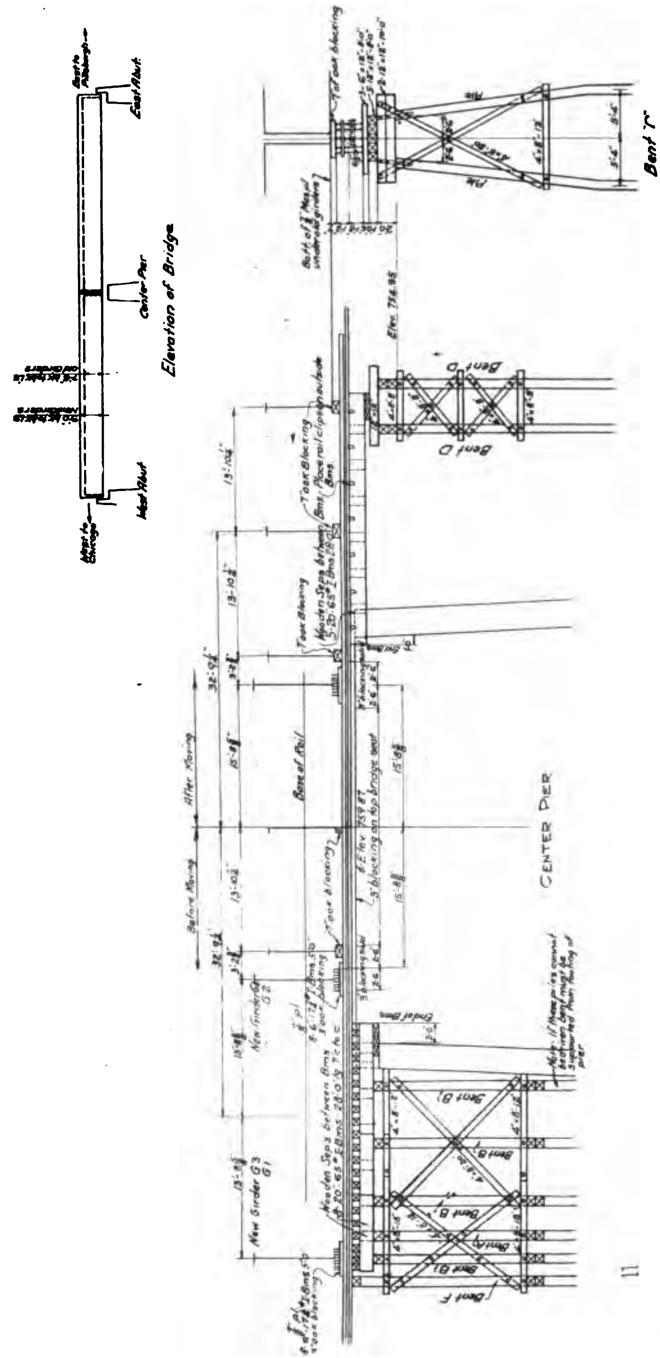
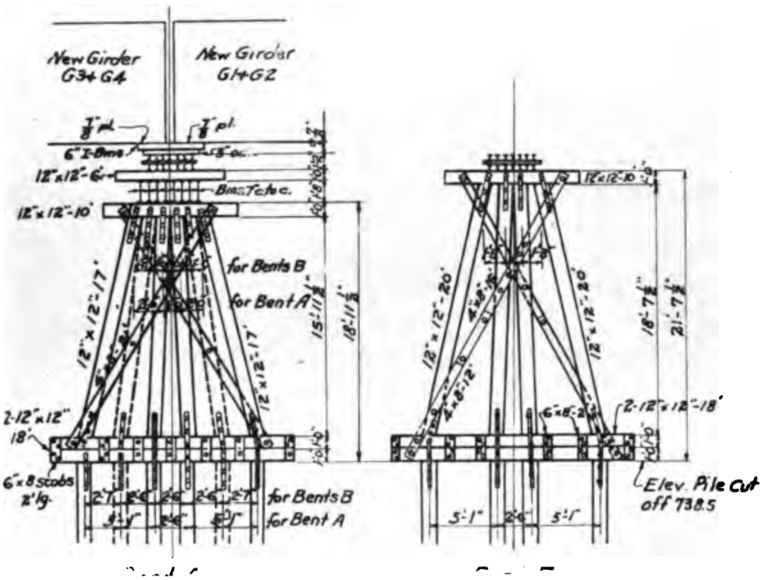


Fig. 10. Bridge No. B-8, Eastern Division, Chicago & Northwestern Ry.



ELEVATION ALONG CENTER LINE OF TRACK

Fig. 11. Bridge No. 259, Pittsburgh, Fort Wayne & Chicago Ry.



Part of Fig. 11, Bridge No. 259, P., F. W. & C. Ry.

Figs. 12 and 13, Bridge 134, Missouri Div., C., R. I. & P. Ry.

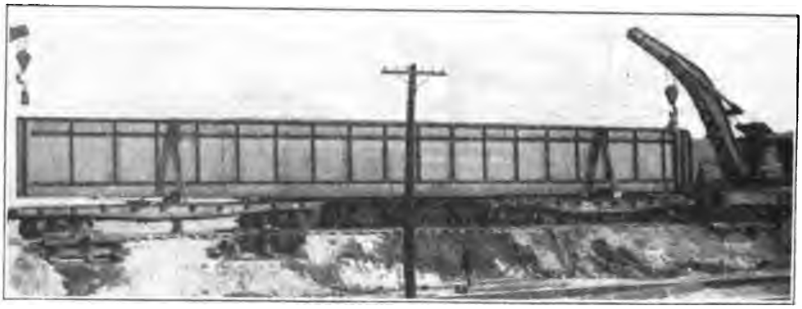


Fig. 14

Fig. 15

Fig. 16

Figs. 14, 15, 16. Overhead Bridge, Lackawanna R. R. **(See Figs. 17, 18, 19)**

Fig. 17

Fig. 18

Fig. 19

Figs. 17, 18, 19. Overhead Bridge, P. R. R. and Buffalo Creek R. R.
(See also Figs. 14, 15, 16)

DISCUSSION

The President:—The discussion of this report is now in order. I am sure there are just as many ideas on the erection of plate girder spans with the least interruption to traffic as there are men in this room. I can pick out a dozen men who have had a lot of experiences along that line, and if they will tell some of them, it will add a lot to the value of the proceedings. Mr. Reid, can I call on you to open the discussion?

R. H. Reid:—We had a bridge at Franklin, Pa., consisting of three 125-ft. double intersection, riveted Leighton truss spans which were to be replaced with six girder spans 62 ft. 6 in. long. A concrete pier was built in the center of each opening and the tops of the old piers were remodeled to receive the girders. When the change was made the girders were run out on the bridge on cars and hoisted with tackle hung from the upper chords of the trusses after which the cars were removed. After the rails, ties and floor system of the old bridge were removed the girders were lowered to their permanent position on the piers, the ties and rails replaced and traffic restored. These movements were all made between trains with no interference to traffic. The trusses were then removed with the aid of two steam wreckers, taking a hitch at each hip and removing them bodily to one side where they were afterwards cut up.

Owing to the increase in the weight of traffic we took down an old Post truss span last year that had been built originally for a double track bridge across the Harlem river and remodeled it for a single-track span for the Valley branch. Before removing the old span from the Harlem river we built a pier beneath it, the old span and a portion of the approaches being replaced with two spans of plate girders each about 100 ft. long. As the river bottom at that location was sand we had to drive a pile foundation and for lack of a better method we used a steam hammer suspended by block and tackle with guy lines to hold it in position. It was a slow job but we drove the piles without having to dismantle the truss to any great extent. After the pier was built we drove the piles which were to support the truss in the same manner, dismantling the truss and removing the floor system and then placing the girders and putting in the new floor system.

Another case was at Petersburg, Mich., on the Monroe branch, where we placed a through Howe truss span with deck girders.

The method was the same as at Franklin. We ran the girders out on the track on cars, raised them off the cars with tackle hitched to blocking on the top chords, pulled the cars out, took out the floor, and lowered the girders onto the piers. We had no occasion to brace the bottom chord in either case. We put a little extra vertical bracing in the Howe truss at the top to stiffen it against lateral movement.

We have erected many spans of bridges over highways, where we have concrete slabs that are waterproofed and carry ballast and ties in them. These are generally erected, concreted and waterproofed complete at one side, and the ballast, ties and rails put in place on the structure. Then the old bridge is removed and the new one slid into place and lowered onto the pedestals. We have moved some in that way that weighed 150 tons. We put a three-span bridge in Cleveland last week, and we are putting in another today in that way, sliding them into place. We have two spans at Gary, Ind., which we expect to put in place next week, over the American Sheet & Tin Plate Company's new subway.

We have erected some girders, with the help of wrecking cranes. Our derrick cars or steam wreckers will pick them up with the boom, carry them out ahead in the case of short spans, and lower them into place. In the case of long spans on double track, we run them out on one track and lower them into place on the other track.

At one point we replaced a through Pratt truss span with a through plate girder span 85 ft. long. We took down the trusses with ginpoles and hand work, and used a pile driver to take out the floor system of the old iron truss and put in the floor system of the through plate girder span. Then, after the floor system was all in, we moved the two main girders to place, put them in, and connected them up on the ends of the floor beams for riveting. We had to use wreckers for that. Each girder weighed about 35 tons. We performed all of those movements with no interference with traffic.

L. Jutton:—In the case where you replaced the Howe truss spans with deck plate girders, how did you handle the falsework for dismantling the old trusses?

R. H. Reid:—We didn't put in any falsework. We carried the new girder spans on the old truss, to put them into place, and carried the old trusses on the new spans when taking them down.

J. S. Huntoon:—In the erection of most of our bridges, particularly on the main line, we have been able to get the operating

department to use a single track, and give us the other one. That makes it very easy to erect the new girders,—put on a concrete floor, if necessary, and then shift traffic over to the new bridge and wreck the other. We erected some through plate girders in Canada recently in the place of a through truss. The old truss was supported on piles. We built concrete piers for the new girders and ran them out there, removed the falsework and jacked them down in place, and then drove a few piles to support the truss and took it down.

Where we have had the most trying cases, as Mr. Jutton spoke of, is at navigable rivers. We had that in the case of the Welland Canal over in Canada, where, even in the winter time you couldn't block it for navigation. At this particular place there was a big draw bridge, I think 200 ft. long. Piles were driven at one side, the old draw bridge slid out and traffic turned over it. It was placed far enough out that it would swing and clear the new bridge. Then the new bridge was erected across the track and swung to its new location. Most of our draw bridges have been erected over streams that were frozen in the winter time, so we have simply driven piles and erected the new bridge in that way. I think it is largely a question, as Mr. Jutton said, of traffic conditions and the time one has to work.

G. W. Andrews:—Mr. Jutton's report has, in a general way, outlined very clearly the methods that could be used, have been used, and will be used in the future, but, as he states in his concluding paragraph, the subject can often be treated in accordance with the local conditions. I have been connected with the placing of a great many new structures within the last 35 years. During that time we have used many methods. I think we have used practically all the methods described by Mr. Jutton, in addition to many more. In cases where it can be done economically, we have always felt that the quickest and safest way is to build the new bridge completely outside the old one and then slide the old bridge out and the new one in. That, as a rule, can be done in a very few minutes, even with double track bridges, of which we have placed a great many in the last few years.

During the present year, we had occasion to renew an old Bollman truss of about 80 ft. span. I don't know whether you are familiar with the Bollman truss or not, but it is of a rather peculiar construction, first designed and built by Wendall Bollman back in the '50's. This type of bridge was built first on the Baltimore &

Ohio, and the structure I have mentioned was one of the first bridges crossing the Opequon creek, on our Shenandoah Valley Line down to Lexington, Va. We replaced a through truss with a deck girder, and we felt that it would not be economical to put in falsework on which to slide it in, or to support the track. Mr. Tanner designed and carried out a method of suspending the girders from the truss, and then taking the floor system out, which was easily done, as it was not connected by block hangers. He then pulled out the cars and dropped the floor system into the creek, after which the girders were lowered into place, ready for traffic. After completing the placing of the girders we disconnected the lateral system and the additional work put on to carry the girders, dropped the trusses into the creek and then cut them up with an acetylene torch. The material was all scrapped. This was a very quick and ingenious way, and, as it developed, a very economical one.

Another case I have in mind was carried out in the same manner while placing some 80 ft. girders on our Washington County branch, crossing Antietam creek. We assembled the girders separately at the end of the bridge, took a couple of flat cars and placed or suspended a gallows frame over the end of each car. We then ran the cars out into place and lowered the girders into position between trains. As it was on a branch line and as we made the change on Sunday we had a little more time than normally and we made a very complete and economical job of it.

J. D. Moen:—(By letter) The standardization of methods to be used in the erection of girder span bridges with the least interruption to traffic is practically impossible on account of the many features involved in such work. Each location requires special methods to suit the local conditions, except where a number of spans are to be erected under similar conditions of ground and traffic. Of the many features to be considered before deciding on the methods to be employed in erection work without interruption of traffic are the length and design of the span to be erected, whether the girders are to carry single or double track, the kind of structure it is to replace, the ground conditions at the location where the span is to be placed and the frequency of traffic to be provided for.

In many locations on all railroads girder spans are being erected to replace truss spans of various lengths and design and in many such cases deck girder spans are used. In past years

where such a change was contemplated the first feature considered by erectors was falsework which was usually placed to carry traffic during the time the change was being made and also to facilitate the dismantling of the old trusses. As traffic increased it was found that the building of falsework invariably entailed more interference with traffic, in the way of short delays to trains, than did the work of erecting the girder spans; consequently practices have changed and in many cases deck girder spans are erected to replace single track truss spans without the use of falsework, except as is required to support the old trusses while they are being dismantled. This practice is followed generally on our lines and in the past two years 13 single track truss spans of various design and of lengths ranging from 120 ft. to 250 ft. have been replaced with deck girders without the use of falsework and without interruption of traffic. The time required to make the changes and get the track ready for the passage of trains varied from 1 hr. and 40 min. for 70-ft. girder spans to 4 hr. for 100-ft. girder spans.

Where the floor beams of the spans removed are of the suspended type, deck girders are assembled and riveted complete before placing, and where the floor beams of the old bridge are supported the girders are assembled in place and riveted under traffic.

There are many locations where, on account of the density of traffic, the track cannot be abandoned for the length of time required to make changes in this manner, and in such cases it is necessary to employ other methods.

Where the floor beams of the old spans are of the supported design, girders of lengths up to 80 ft. are handled with one derrick, and the procedure is as follows:—Girders, cross frames, and lateral braces are unloaded as near the final location as possible and all cutting of old spans that can be done with safety is completed beforehand. The track is taken up and the old floor is taken out, usually in sections of three floor beams and two sets of stringers in each section, after the miscellaneous parts are removed. This makes it possible to remove the old floor with three or four moves of the derrick car. The girders are then set to place and assembled and the track made ready.

Where girder spans over 80 ft. long are being set under similar conditions, two derrick cars are used; the girders are hauled out to the final location on flat cars and are set on false

bents resting on the new piers and of sufficient height to permit taking up the old floor in the manner outlined above. After the girders are rested on the supports and fastened to the old trusses the flat cars are disposed of and the method of procedure is then the same as outlined above, except that two derrick cars are used instead of one. A crew of 18 men, including 2 foremen who are accustomed to making changes in the manner outlined, and with proper equipment, can place a girder span and make the track ready for trains in 3 hours.

Where girder spans are being erected to replace truss spans with suspended floor beams the performance is as follows: All cutting that can be done with safety is completed beforehand. The girder spans are assembled and riveted complete, loaded on two flat cars and hauled to the site. The new span is supported on bents resting on new bridge seats, these bents having both vertical and horizontal clearance sufficient to permit moving the flat cars and to be dismantled easily for quick removal after the span is lifted from them. When the new span is transferred onto the bents, dispose of the flat cars, take up the track, lower the old floor system to clear the girders, set the girders in place and restore the track. Six spans were recently set in this manner on one job on our line and the track made ready for traffic in an average time of 2 hr. and 10 min. for each span.

When through girder spans for single or double track are being erected to replace through spans of any design, it is usually found to be more expedient and economical to erect falsework where local conditions will permit. In locations such as overhead railway crossings, where falsework cannot be maintained on account of insufficient clearance, and where, on account of the frequency of traffic the track cannot be abandoned long enough to permit making changes that would take five or six hours, the method generally used, i. e., erecting the new spans on false piers or abutments and rolling them to place, as the old spans are rolled out, cannot be improved upon.

There are numerous locations on nearly every railroad where through girder spans are erected to replace timber and pile trestles in double track districts, such girders being designed to carry two tracks and at such locations both tracks cannot be abandoned long enough to permit the erection of the span in place without causing train delays. In such cases the best method is to erect the span on falsework opposite the final loca-

tion, load it on rollers and roll it to place after removing the temporary bridge. Moving heavy spans on rollers is considered much better practice then sliding them to place, as much less energy is required and there is less danger of delay through failure of some part of the rigging. If it is desired to make the change in the least possible time the falsework is also cut to clear the girders, and loaded on rollers beforehand and moved out as the new span is moved into position.

For placing spans after assembling and riveting them complete on falsework opposite the final location, we have a set of low, powerful twin roller dollies, or trucks, designed for the purpose and built at our own shops. They are capable of carrying any load required of them, with safety, and can be handled easily by one man. By the use of these dollies on rollerways of track rails, heavy spans can be rolled to place with comparatively little exertion. Changes are made and the track made ready for traffic in a shorter time by using this method of removing falsework and placing spans than in any other manner. Dollies, or trucks used for rolling spans into place are designed to carry the dead load only and provision is made for placing the span on the permanent shoes or bases immediately when it reaches its final position. This method of course may also be applied in the erection of deck girders, but it is seldom found necessary.

If traffic conditions are such that they permit the abandonment of both tracks for a period of 1 hr. and 30 min. twice each day without interference, the best method is to assemble the spans in place and do the riveting under traffic. One floor beam and two sets of stringers can be set in the time stated if proper provision is made for removing the falsework and the erection crew has plenty to do to fill in the time between shifts. This also applies to the erection of single track girder spans, whether straight or askew and whether open deck or ballast floor.

On our line we recently erected eight 100-ft. deck girder spans at one location on piers 61 ft. high. It was found that the setting of the girders temporarily on the ends of the piers outside the ends of the caps, as is often done while falsework is being removed, would entail too much cutting of falsework, therefore it was decided to remove the falsework and then carry the girders to their position and assemble them in place. A

bridge erection derrick, capable of carrying one of the girders, was included in the equipment, but on account of the track being on a new fill at the ends of the bridge, it was not considered advisable to move the girders out in this manner. Two derricks and a truck, or dummy, capable of carrying the girders were provided. One of the derricks with a boom having a horizontal reach of 50 ft. was spotted at one side of the opening after the falsework was removed. The girders were loaded, balanced centrally, on the dummy car, or truck, by the other derrick and moved out until one end extended out over the opening far enough so that it could be reached conveniently by the derrick with the 50-ft. reach. The girders were then lifted off the truck and both derrick cars moved until the girders were directly over their final position when they were lowered to place. This work was done on a branch line where traffic conditions permitted the abandonment of the track for a period of 4 hrs. each day. One span was placed each day until all were completed.

In placing either deck or through girders for single track of lengths up to 50 ft. the best method is to erect and rivet the spans complete on ways convenient to their final location, then lift out the falsework and lower the girders to place. This is done with 3 or 4 moves of a 40-ton derrick car in very short time. Much could be said on this subject in the way of performance schedules to be followed in the course of erection work, but it would be useless for the reason that each location must be handled individually to suit local conditions.

This is not intended as a treatise on the erection of bridges, nor are the methods outlined herein suggested as the best methods to be employed generally, but they are methods which have been used by the writer to suit local conditions and they are offered for the purpose of giving strength to the statement that methods cannot be standardized. The methods outlined proved entirely successful wherever used and therefore they can be considered best suited to the locations where employed.

It is a fact well established to every bridge erector that the first feature to be considered in connection with erection work is the organization. In order that such changes as are required to be made in erecting bridges under traffic, may be made successfully, and delays to traffic avoided, certain moves must be made at a specified time and every move must count. Therefore in planning such performances the organization must be consid-

ered carefully. Plans must be made for certain moves according to schedule and the schedule must be complied with. I have noted a variation of two hours in the amount of time consumed on jobs which were identical in every respect and where by actual count the number of moves made, or which should have been made, were the same. The variation in time was due to improperly organized forces. We may make plans and performance schedules to follow in erection work the same as in other lines, but it must be left to the man on the job to work according to such plans and schedules. In other words much of the responsibility for carrying out such plans and schedules rests with the "Man behind the gun."

In this day we have improved machinery and work equipment which eliminates man-labor to a large degree, but to offset this we find that it is becoming more difficult each year to get the man who will, to use a well-known phrase, "put his hands on it and do it." We have just as good men in erection work now as ever but it is often difficult to get proper team work to carry out a performance schedule. A well organized erection crew, where each man knows the limitations of his fellow worker, will accomplish twice as much on erection work as a poorly organized crew where no man trusts the other. All these matters must be given consideration when preparing a performance schedule.

Much attention must be given to the using of machinery to the greatest possible extent. Show any workman that you are trying to conserve his muscle by using machinery for all heavy work and he will usually pitch in with the right spirit and give the best he has in him in the way of efficiency. Therefore, I would say the Best Method to Use in Erecton of Girder Spans with the Least Interruption of Traffic is: Choose the method best suited to local conditions, provide adequate machinery, rigging and tools, get an organization that will use team work and then go to it.

CONCRETE CASING FOR THE PROTECTION OF STEEL STRUCTURES

By E. E. R. Tratman

Western Editor: "Engineering News-Record," Chicago, Ill.

Maintenance, repair and renewals are bogies and hobgoblins that haunt and harass the engineer and superintendent who has steel structures in his charge. Inspection and painting, reinspection and repainting, and again inspection and painting, make an unending trail that is interrupted only by the slough of occasional repairs, the rocky ridge of partial renewal, or the temporary wayside resting place of renewal or reconstruction. Wind and weather, sun, snow, rain, the dry sand of the desert, the wet muck of the swamp, the acid or briny drippings from cars, the gases and cinders from locomotives, the vibration and impact under traffic, all these and a host of other sprites and unholy influences are everlastingly at work to impair and destroy the kindly protection of the paint and to attack the timid and defenseless steel thus exposed.

As the superintendent of bridges starts to fight this host of never-resting foes with his paints and protective coatings, a detaining hand is sometimes laid upon him. He may be warned that paint costs money and must be used sparingly; let the job go till next year. Or his favorite poison is too costly, and he must get along with something that is "just as good" and costs less. When he does get into the field, other difficulties face him. It may be that his paint is being slapped upon damp and dirty surfaces. Or perhaps awkward pockets and places difficult of sight and access are being skipped, to remain as choice dens and workshops for the demon decay, the creeping corrosion or the ruthless rust.

The extensive and increasing use of concrete structures on our railways during recent years has been due in part to the fact that they involve practically no maintenance expense. With good concrete and well-made structures, maintenance, inspection and repair become merely pleasant companions for the superintendent of bridges and buildings. They take him out occasionally for a pleasant trip to convince himself of the good condition—instead of the bad condition—of his bridges and other works.

Here then we may seem to have reached unexpected goodness, finality and the smooth waters of a haven, sheltered by a concrete wall which will permanently resist the attacks of the enemy. Therefore let us build all our structures of concrete and leave them to take care of themselves while we take up other matters. But he needs a long spoon who sups with the devil, and if our destructive enemy cannot get through our invulnerable wall, he can perhaps get over or around it, and again we have to engage in battle.

We find that concrete has its limitations. The engineer plans a long-span bridge. Bang: the door is blown in and old Demon Decay is on the threshold. Concrete cannot be used. Steel is unavoidable and essential. The engineer dashes down a dark alley in search of a non-rusting, non-corrodible, absolutely everlasting and ever-resisting steel. He is still plodding after that friendly but elusive sprite.

We find that even concrete is subject to evil influences. Again, note the qualifications of concrete mentioned above: "good concrete," and "well-made structures." A mixture of cement, sand, stone and water is not always concrete. Water bewitched, cement begrudged and

aggregate inferior does not make a high-grade concrete. And if carelessness and incompetence are in charge of the work, the superintendent's troubles may begin to break out in a new direction. A crack here, a scaling there, a porous patch elsewhere, afford points of attack, and may be more obvious and unsightly defects than a worn coat of paint on a steel structure.

Well, we seem to get nowhere. Steel is troublesome. Concrete may be less troublesome, but it has its own defects and cannot always be used as a substitute. At this stage, when we may well begin to feel pessimistic, a brilliant idea strikes somebody with a flash like lightning in a powder mill. Where steel **must** be used, why not encase it in concrete instead of coating it with paint. No sooner said than done, and the engineer and bridge superintendent are now working actively along this line.

Here too are obstructions and limitations. On very long spans the added weight of the concrete becomes inadmissible. There is necessity of absolutely close adherence of the concrete to the steel. There is possibility of moisture passing through the concrete and causing corrosion of the concealed steel. There is liability of cracking under temperature and vibration movements of the steel. Nevertheless this is a promising field, which widens as we go farther into it.

The practice of applying a concrete casing to girders, viaducts and other steel structures has been adopted on a considerable scale, and is on the increase. It is employed for three reasons, more or less in combination: First, to protect the steel against atmospheric destructive influences; Second, to protect it against the destructive effects of the hot gases and cinder blast from locomotives; and Third, to improve the appearance of the structure.

The casing may be of three kinds. In the first place it may be of ordinary concrete placed in forms as in usual practice. In the second place it may be concrete mixed under steam pressure with about 50 per cent. superheat, and then blown into place through a small pipe by steam pressure. In the third place it may be a cement-sand mixture known as gunite which is blown upon the steel through a hose by compressed-air. Density is a special feature of concrete or gunite applied by pressure, and the steam-placed concrete is said to weigh about 170 lb. per cubic foot, as compared with 135 lb. for concrete made and poured in the usual way. And density is specially desirable in work of this kind.

Steel reinforcement is required in any case, with special attachments to bond the concrete to the steel. Longitudinal rods are generally used with wire mesh over flat surfaces and projecting flanges, and around small members. Sometimes cross rods or anchors are put through the girder webs. According to a report from the Kansas City Terminal Railway, in the 1916 "Proceedings" of the Association, the cost per square foot is about 25 cents for concrete placed in forms, and 23 cents for "gunite" placed by compressed air and the cement gun. These prices include concrete, reinforcement and labor.

When ordinary concrete is used a relatively thick mass must be applied. There is doubt sometimes as to the close adhesion of the concrete to the steel, and as to the protection against moisture which may be absorbed by the concrete and thus come into contact with the steel. On the other hand, this method permits the formation of panels, molding, etc., to relieve the surface and give an effect of architectural treatment. A rich mix with small-size coarse aggregate is required, the mix being very generally 1: 2: 4.

The gunite, applied by compressed air, differs from ordinary concrete in having no coarse aggregate, as the material has to be applied with a hose. It is usually about a 1:3 mix. This material has the special advantages of high density, with small absorption of moisture, and close adhesion to the steel.

Concrete casing of steel bridge work has been employed in several

cases on track elevation work in Chicago. A prominent example is the skew bridge carrying the Rock Island tracks across the Chicago & Western Indiana, at 79th St. There are five through plate-girder spans of 85 to 90 ft., with plate girder floor-beams resting in the bottom chord, and having their tops enclosed in the reinforced concrete deck slab. Beneath the deck is a 5-in. slab at the level of the chords of the girders, protecting the steel from the blast of locomotives passing under the bridge. Steel bars are run through holes in the stiffeners, and wire mesh is laid over the chords, webs, gussets to floor beams, etc. The concrete coating was applied by the cement gun. It is 1¾ in. thick on the girder webs, gussets and other flat surfaces, 2 in. under the floor beams, and 3 in. on the chords of the girders.

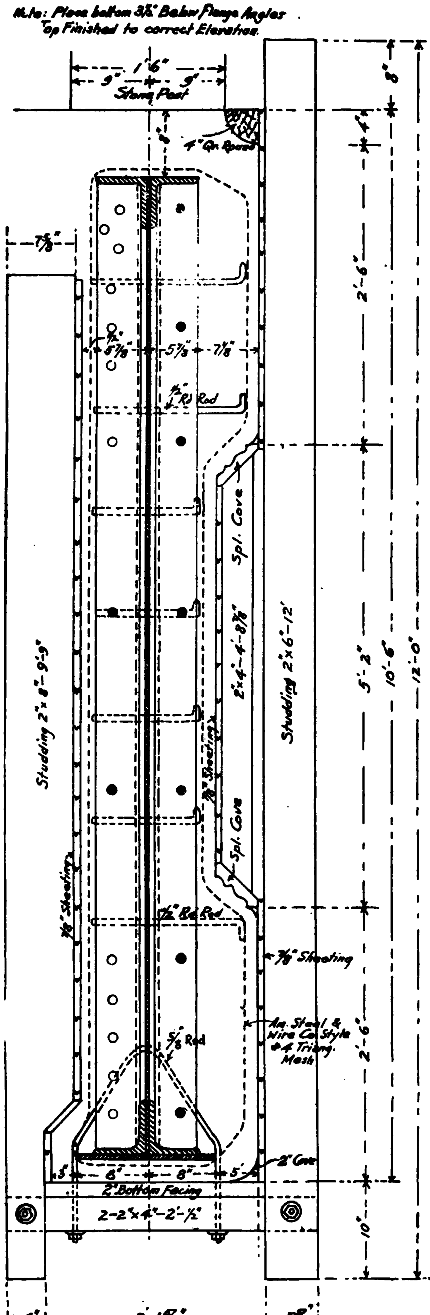
Poured concrete was used for the bridges on the track elevation of the New York, Chicago and St. Louis from 73rd St. to 79th St., Chicago. The 75th St. bridge is a typical example. This has two 25-ft. roadway spans and two 10½-ft. sidewalk spans, with through plate girders and a floor of transverse I-beams embedded in a concrete slab with reinforcing of steel rods and wire mesh. Each post of the bents is composed of two channels and an I-beam, and the posts are connected by diagonal braces of four angles with web lacing. The casing of girders and decks forms one solid mass. That of the bents gives finished rectangular sections. The concrete is a 1: 2: 4 mix, using 1-in. stone, and is at least 1½ in. thick over all steel. The estimated cost of the concrete casing is as follows (1912 prices):

Concrete, 180 cu. yd. @ $10.00,	$1,800
Wire mesh, No. 23, 2550 sq. ft. @ $1.98 per 100,	51
Wire mesh, No. 74, 4850 sq. ft. @ $0.58 per 100,	28
Wire, No. 14, 63 lb. @ $1.35 per 100,	1
Rods, 2370 lb. @ .025 per lb.	59
	$1,939
Allowance 15%,	291
Total,	$2,230

On the long-span girder bridge carrying this line over the Illinois Central the concrete floor is shaped to form jack arches between the webs of I-beams, the lower flanges being heavily encased. The columns and the transverse trusses between them are cased in concrete but the girders are not so cased above the floor level.

At Layfayette, Ind., the Main St. bridge over the river is a steel plate-girder structure, having six spans of 126 ft., with the outer girders cased in concrete. This was done mainly for the sake of the appearance. The bridge was built in 1913-14. Owing to the fact that the concrete was placed during extremely bad and some very cold weather, the appearance was not as good as desired. The principal trouble was in placing the concrete. The forms were not sufficiently rigid to carry the whole mass at one pouring, so that it was necessary to let the concrete set when about half of it was poured. The result was a seam that is noticeable in the work. The concrete was bush-hammered with pneumatic tools after it had darkened. The general appearance is good with the exception of the mark above referred to. There has been no cracking of any kind in the surface up to this time, nor separation of concrete from the steel. The concrete was a 1:2:4 mix.

Cross-rods are put through the girder webs, averaging one per square foot of surface. These are ½-in. rods, with threads cut half way, and nuts screwed up against each side of the web to hold the rods in position. The unthreaded end of the rod was bent sharply at a right angle. These rods were of such length as to reach within 2 in. of the surface of the concrete. Longitudinal rods were passed through holes in



Cross Section of Concrete Casing for Girders of Main Street Bridge, Lafayette, Ind.

the stiffeners, and a sheet of wire-mesh extended around the girder and the edges of the cross rods.

The forms were held by inverted U-bolts, having the upper portion of V-shape passed through the girder web. The lower vertical portions of the legs passed through cross timbers supporting the forms. In this bridge the spans were too long for concrete girders, and arches would not have given the desired clear waterway for flood flow.

A very exceptional and interesting example of the use of concrete casing is the viaduct approach of the St. Charles Bridge of the Wabash Railroad over the Missouri River. This old viaduct or trestle, with Phœnix columns, built in 1884, was designed for Cooper's E-25 loading. About 1900 its strength was increased by filling the columns with concrete. In 1910 it was strengthened for E-50 loading by converting it into a reinforced-concrete trestle. For this the old columns and struts (all Phœnix sections) were encased with concrete in which the necessary reinforcing rods were embedded, together with a spiral steel wrapping. As an experiment one four-post tower was treated in this way in 1908, in order to see how the concrete would stand exposure and vibration. The results being successful the complete work was carried out in 1910. Laboratory tests of sample columns indicated that the strength had been nearly doubled.

The shoes are enclosed in concrete blocks. The concrete columns are of octagonal section and the struts are of rectangular section, with gusset connections to the columns. These gussets enclose the ends of the diagonal rods, the rods being left in place although they are not needed in the reinforced concrete structure. After the base or shoe blocks had set, the steel rods and wrappings were placed and the forms set in position. The concrete was a 1:3 mix of cement and sand. The column casing averaged 0.0590 cu. yd. per lin. ft., while the interior filling averaged 0.0074 cu. yd., making a total of 0.0664 cu. yd. per lin. ft. of column.

The concrete was poured from a work train on the structure, equipped with mixer and material cars. The work is described fully in Engineering News of Nov. 10, 1910. It was done by the W. P. Carmichael Co. on a force-account system, as cost estimates of such work could not well be made. The design and execution were under the direction of Mr. A. O. Cunningham, Chief Engineer of the Wabash R. R.

There seem to be possibilities of the application of this treatment to water towers, coaling stations and other structures.

An instance of the use of concrete casing for the sake of appearance is the track-elevation viaduct of the Baltimore & Ohio across Independence boulevard, Chicago. It is a four-track plate girder structure 250 ft. long, with two 35-ft. spans over the driveways. These are made distinctive by heavy piers and by decorative treatment of the piers and the girder casing. This was poured work, using a 1:2 mix of cement and crushed limestone, without sand. The aggregate ranged from dust to ½-in. size.

A more elaborate example of the combined protective and decorative use of concrete casing is a portion of the Boston Elevated Railway, at Forest Hills, Mass. The four-post steel towers are encased to represent masonry piers. The outer girders have curved brackets supporting a curved mask of concrete which extends from the bottom chord of the girder to the edge of the deck, where it is surmounted by a concrete parapet wall. The girders are then well covered with concrete. The top chords are embedded in the concrete deck slab and the bottom chords in a light slab which serves to conceal them from below. This is all poured concrete, a 1:2:4 mix, using ½-in. stone. This work was reported in 1917 as being entirely successful and satisfactory. In some places on the water-table the concrete had cracked away from the reinforcement, but this was through no fault of the concrete work. The color has darkened somewhat since the concrete was new. Somewhat

similar treatment has been applied to the station and structure of the New York Elevated at Pelham Parkway. This was a 1:2:4 mix, made with ¾-inch stone, and spouted to the forms from an elevator tower. A bush-hammered finish was given and some inlaid tile decoration was included. As described in "Engineering News" of January 4, 1917, this cost $12 per cu. yd. of concrete.

In the track elevation of the Boston & Maine at Lynn, Mass., concrete masking of the girders was required by the legislative act relative to the work. This is not a protective casing, however, the concrete being applied only on the outside of each outer girder. This also was form work. Its cost was $4.25 per sq. yd., in 1914-15. Much of the masking was done during the winter, steam coils and straw packing being used to heat the forms and prevent the concrete from freezing. A recent example of poured concrete casing is the three-span through plate-girder bridge carrying Cambria St. over the Philadelphia & Reading at Philadelphia. The concrete was used largely as a protection against corrosion. It is a 1:1½:3 mix, anchored to the girder webs by 1¼-in. bars spaced about 12-in. centers. The surface was bush-hammered, or lightly chiseled by hand at places where use of the hammer might cause spalling. The cost of this concrete was about $10 per cu. yd. ("Engineering News-Record," April 5, 1917.)

Reference may be made to the Wabash bridge over the main entrance to Forest Park at St. Louis, as this is sometimes incorrectly mentioned as an example of concrete-encased steel structures. This is a through plate-girder bridge of 80 ft. span with exterior concrete facing. The steel is not cased in concrete, however, and the latter serves merely to conceal the girders and give an attractive appearance to this bridge over a pleasure driveway. The concrete facia girder and railing are 3 ft. from the steel girder, and are built upon angle iron frames attached to the web and bottom chord of the girder. The frames are about half the height of the girder and carry a wooden covering between the steel and concrete, thus forming a tar-and-gravel gutter. The concrete girder was built in a wooden form attached to these girders, but the ornamental railing which surmounts it is composed of pre-cast balusters and copings. This work was done in 1903 and has proved very successful.

In all decorative work, care must be taken to prevent surface cracks or crazing, and patchiness of color. In the Baltimore & Ohio work at Chicago noted above, special care was taken to have all concrete of uniform proportions and consistency, so as to maintain uniformity of color. After the forms had been removed and the concrete seasoned for a few days, all ridges were chipped or filed off. The surface was then wetted and rubbed with carborundum brick, and then a thin wash of cement and sand was applied. When this was dry a rubbing was given with a finer carborundum brick, until the cement wash was all removed.

Reviewing the situation, what does experience teach us and what relief is promised to the engineer and the superintendent of bridges? In the first place, concrete casing promises certain advantages in reducing the amount and cost of inspection and maintenance of steel structures. As an example of this, one road reports that repainting steel bridges averages 60 cents per ton per year, while for concrete casing done a few years ago there has been no maintenance cost as yet, and no cracks or defects have appeared. Concrete also has an advantage as a mechanical protection, affording additional resistance to the attacks of gases, acids and cinder blast.

Two points are essential for permanent success: The concrete must have close adhesion to the steel, so that moisture cannot get between the steel and concrete, and the concrete must be dense, so that moisture cannot work through the concrete to the steel. Remember that the steel cannot be painted if it is to be cased with concrete, as that will impair the adhesion. Therefore, if Old Man Moisture can get

through or around the concrete he finds his prey, the steel, bare and exposed to attack.

In listening to this paper you have heard of several unfriendly and insidious influences; Demon Decay, Creeping Corrosion, Ruthless Rust, and Old Man Moisture. You may wonder why no Good Fairy of Permanent Protection is mentioned. The reason is that no such ally has yet been found. We have found some ways of circumventing the numerous enemies. But the battle continues. Therefore, "Carefulness, Watchfulness and Persistence" must be the slogan of the Railway Superintendent of Bridges and Buildings.

DISCUSSION

The President:—I think the association owes a debt of thanks to Mr. Tratman for having presented such an interesting paper, written in such an impersonal way. It would be interesting at any time and is especially so now, as it tells very completely what has been done along these lines. I don't know whether any members have anything to add or not. If so, we will hear from them now.

L. D. Hadwen:—We have employed concrete protection around steel on girders, and we have also applied gunite in some instances to protect the under sides of viaducts where they were exposed to locomotive exhausts. While these methods have not been in service long enough for us to determine definitely, so far no defects have showed up. One essential in the covering of steel with gunite is to get the steel absolutely clean. One must sandpaper the steel in order to get good results.

We find the trouble with applying gunite for the protection of the under sides of the viaducts exposed to the locomotive blasts is that it has been a matter of very great expense to take care of our staging, etc. The places that are most exposed to deterioration from constant traffic underneath the bridge are those where you have the densest traffic. Usually that adds a problem to any gunite work done and makes it very expensive. Of course, in painting you do not need the head room that you do with gunite, for with it you have to have some staging, so the men can work underneath.

C. W. Wright:—On the steel in the terminal of the New York Central at New York they used a cement gun, but they used reinforcing of galvanized wire, probably a No. 7, laced with a lighter wire. I don't know about the results, but I haven't heard anything unsatisfactory lately. If there had been anything unsatisfactory, I believe I would have heard of it.

The President:—I will say from the information I have had on the subject, that all thin coatings will ultimately require some reinforcing to make them successful, whether the concrete be placed as gunite, by compressed air, or placed in forms, and also, that a heavier reinforcement will be necessary. There are many places where cement coverings have been placed on steel in the past, and a very light reinforcement has been put up, presumably on the idea that it was only necessary to hold the concrete there long enough for the concrete to adhere to the steel. Where that has been done, the corrosive elements have eaten out the thin reinforcement, and I think the coating will not be successful unless there be formed a skeleton of rods, to hold the coating in place after the finer material corrodes, if it does corrode, and then a finer mesh, to hold it while it is being placed.

B. F. Pickering:—I would like to ask if it is necessary to apply heavy reinforcement on account of the lighter reinforcement rusting away from the moisture? Isn't it also reasonable to suppose that the steel girder that is encased is suffering the same way? In the paper read by Mr. Tratman he spoke of the steel viaduct in the city of Lynn. I want to speak further on that same viaduct. He evidently speaks only of the viaduct across Central Square West. There is another portion of this which is of steel, and is also encased in concrete. The protective coating over it was not sufficient to keep the water out and I find that it runs down between the cement coating and the steel beam. It is a very grave question with me how long that steel is going to stand that action without deteriorating to such an extent that it will become dangerous, with no chance to inspect the steel. It looks to me that unless the water is kept out between the steel and the concrete, the concrete will become a menace, rather than a help, in the preservation of the steel.

The President:—I think there is no question in a case of that kind but that the concrete covering should be cut out, because if the water gets to the steel and continues to run, there is no question but that the steel is going in time. The corrosive elements that I referred to are those that come from absorption from the outer surface of the concrete and will soak in far enough to get to the steel. Of course, with the heavier rods, the chances of the corrosive elements getting through the concrete far enough to get to the plate steel are very slim, but in the

other case that was mentioned, the only safe thing is to find out immediately where the water is getting in, and stop it.

G. M. Hoffman:—We have two subway bridges with steel ceilings on the Shamokin division, and they are constantly leaking and rusting the rivet heads and different parts of the ceiling. One bridge has been built four years and the other three years. I painted both of them this summer, when I discovered that quite a lot of rivet heads had been rusting, and that there was a continual dropping of water. The bridges were not completed a year before they started to leak. There must be water in back of the steel ceiling for it keeps dropping through. Should openings not be made so the water could get out?

The President:—What you need is an efficiency system of water-proofing which will shed the water and keep it from getting in. Any complete system of water-proofing will stop the water and throw it off. I know that when I was on the Lake Shore about 15 years ago, we had a number of bridges where the steel floor was rusting out. An efficient system of water-proofing was put in and the steel didn't corrode any more.

REPAIRING AND STRENGTHENING OLD MASONRY

REPORT OF COMMITTEE

Soon after the appointment of the Committee on the above subject, of which A. I. Gauthier was chairman, a circular letter was sent out requesting suggestions in connection with the preparation of a series of questions to be submitted to the various railroads in the hope of securing reliable data on the above subject. A consideration of the replies received by the chairman resulted in the preparation of the following set of questions:

Abutments and Piers

1. Assuming loads are not to be increased, when do you consider it advantageous and effective to:

(a) Pin and point joints in the face of old stone masonry originally laid dry where walls are not to be grouted at the same time?

(b) Grout masonry originally laid dry?

2. Assuming loads are to be increased, when would you consider it advantageous and effective to grout masonry originally laid dry?

3. Give a detailed description of the apparatus and methods used (with sketches and photographs if possible) on any important work where grouting of the old masonry laid dry has been resorted to and the success which has been obtained.

4. Give a description of the methods used and the results obtained in strengthening masonry that shows signs of failure owing to:

(a) Insufficient sections.

(b) Yielding foundations.

When conditions are such that:

(a^1) No additional work will be permitted in front of the existing masonry.

(b^1) When there is ample room for buttresses, etc.

5. When abutments are partially undermined, give a description of the methods used to repair them.

6. When conditions referred to in questions 4 and 5 arise, give the methods used to maintain traffic while repairs are under way.

7. What experience have you had and what success have you obtained in tying together defective parallel wings of bridge abutments with iron rods?

8. Give a description of the methods used to strengthen old masonry of all classes to carry heavier loads.

(a) To distribute the load from the superstructure.

(b) To reinforce foundations.

9. Give a detailed description accompanied by plans, sketches and photographs where possible, of any important work involving conditions noted in questions 4, 5, 6, or 7, stating whether the work was done by contract or by company forces, with cost data if available.

Arches

1. Give a statement of the methods used in repairing stone arches. If you have had any specific cases, state the condition of the structure before repairs were made, and how the work was handled, giving plans, sketches or photographs where possible and cost data where available.

2. What success has been obtained in tying together the spandrel walls of arches with iron rods?

Retaining Walls

1. Give a statement in regard to the methods used in repairing defective retaining walls, if any experience has been had along these lines.

Before the above list of questions was sent out to the various railroads, Mr. Gauthier entered the service of his country in France, thus leaving the committee without a chairman. Early in August, the present incumbent was requested to act as chairman with the hope that he would be able to get out a report in the absence of the regular chairman.

To date, replies have been received from E. G. Lane, of the Baltimore & Ohio Western Lines; B. F. Pickering, of the Boston & Maine; George E. Boyd, of the Delaware, Lackawanna & Western; John A. Bohland, of the Great Northern; E. M. McCabe, of the Boston & Albany; Moses Burpee, of the Bangor & Aroostook; S. C. Bowers, of the Pennsylvania Lines, West; Lee Jutton, of the Chicago & North Western; and F. E. Schall, of the Lehigh Valley.

Upon considering the data so far received, it was decided to group the replies from the railroads in the same order as the questions sent out.

Abutments and Piers

1. (a) The Boston & Maine, as a rule, does not consider it necessary to pin and point joints in old stone masonry originally laid dry, unless some special case required it. In that section, there are very many pieces of old masonry which were laid dry many years ago and which are of rough stone, that, in many cases, is rough and open. In such cases the labor of pointing is thrown away, unless a more sightly job is required.

The Boston & Albany is of the opinion that with old masonry laid dry, if the foundation is in good condition, pinning and pointing should be done as quickly as possible to prevent the stone from working. Should there be any movement in the masonry, joints would show up.

The Chicago & North Western suggests that joints in old stone masonry, laid in mortar, should be pointed when the mortar has fallen out for a depth of ½ in. in most of the joints. If this is a small job, it can be deferred until other work of the same nature develops in the vicinity.

The Lehigh Valley thinks there is little reason, except possibly for looks, for pointing stone masonry laid up dry, when the walls are not failing, and are not to be grouted at the same time.

The Bangor & Aroostook does not recommend the pointing of old masonry originally laid dry unless grouting at the same time is contemplated.

1. (b) The Lehigh Valley advises that the grouting of dry masonry will greatly prolong the life of the wall if properly done, and recommends closing and pointing the joints for a height of several feet at a time, starting at the foot of the wall, and providing small openings in the walls at intervals, for pouring in the grout, continuing this process until the top of the wall is reached.

The Chicago & North Western does not believe that a good masonry wall can be made by grouting old dry masonry.

The Boston & Albany recommends the prompt grouting of dry walls, especially if there are small and ill-fitting stones in it with a view to preventing movement in the masonry.

The Boston & Maine recommends grouting in a thorough manner, as soon as the walls show signs of the stone working loose.

2. The Lehigh Valley recommends that walls be pointed and grouted before being subjected to heavier loads, to prevent distortion and shifting of the stones.

The Boston & Albany recommends that where old masonry has been laid up dry for any length of time, the walls should be pointed and grouted so as to fill all voids and stop any movement liable to take place

in the old masonry, but if the stone has not been cut, it does not pay to spend much money on masonry laid dry. The experience of this company is that old masonry usually gives plenty of warning, in which case a reinforced concrete bridge seat proves effective. Concrete bridge seats on cut stone masonry laid dry, have been holding up well under increased power, where the foundations were in good condition. This Company does not, however, recommend pointing or grouting if the old foundations are poor and show signs of settling under the old masonry.

The Boston & Maine advises that where the original walls are of sufficient area to carry increased loads and the foundations are in good condition, grouting may be resorted to with economy and usually with satisfaction.

3. The Lehigh Valley advises that the face joints should be thoroughly wedged and packed and then pointed for a height of 3 or 4 feet from the bottom. At that point, small stones should be removed at intervals of every 5 or 6 ft. The grout should be poured into the wall by the use of a pan-shaped, sheet-iron spout, that can be inserted into the wall for a short distance, the grout to be poured until it reaches the height of the pointing. The temporary opening should then be closed and another section of three or four feet in height should be pointed in the same manner as above described, this method to be continued until the top of the wall is reached. The grout should not be expected to run any great distance, and the party in charge of the work should be guided by the condition of the work before him.

The Boston & Maine recommends that the joints of walls to be grouted, should be thoroughly cleaned of all debris and carefully pointed, and that the grout should be placed as far back from the face as possible, using a wet mixture that would run into voids otherwise inaccessible. Results in this class of work have been uniformly good.

4. (a) The Lehigh Valley advises that buttresses or a complete facing of the wall with concrete may be resorted to as the case in hand may require, always anchoring the new wall to the old.

The Chicago & North Western recommends the placing of a jacket of concrete on the old masonry, bonded to it by means of rods or dowels.

The Boston & Albany recommends encasing with concrete, removing a course or two of stone from under the bridge seat and then grouting and replacing the bridge seat with concrete reinforced with old rails.

The Boston & Maine advises that it has had little experience in this class of work, but now has several cases that need attention.

4. (b) The Lehigh Valley recommends, for yielding foundations, the underpinning of the old structure by placing toe walls under the front of the wall. These walls must be placed in sections about 6 ft. in length to avoid further weakening of the structure. To be effective, these toe walls should extend under the old foundations not less than 18 in.

The Chicago & North Western suggests that for ordinary piers and abutments, the most feasible way is to take down the old masonry, construct new foundations and relay the superstructure. In the case of large piers and abutments, a special program should be worked out for repairing the foundation.

The Boston & Albany advises that when necessary to repair structures on account of yielding foundations, excavations are made to good material and the material replaced with concrete reinforced with rails or rods.

The Boston & Maine recommends the use of buttresses when there is sufficient room for their construction, the foundations for buttresses to be obtained by excavating to satisfactory material or providing piles for them. It also recommends the removal of sufficient stone from the old masonry to make a satisfactory bond with the concrete. If the old

structure is too weak to carry traffic while repairs are being made, false work should be installed.

The Great Northern cites an instance of partial failure of the wing walls of a bridge near Dryden, Washington. This structure consisted of high abutments carrying two deck truss spans. The trouble was remedied by constructing pile trestles back of the abutments and removing a portion of the filling. The pile trestles were later replaced by two 16-ft. concrete slab spans on the west end and by one 32-ft. girder and one 16-ft. concrete slab span at the east end. No further movement of the wing walls has been observed since the filling has been removed and the bridge extended as indicated above. A number of other cases similar to the above, were treated along the same lines.

4. (a^1) The Lehigh Valley recommends that when no buttresses can be placed in front of the wall, it may be necessary to place reinforcements in the back of the wall, which may be done by means of buttresses or additional masonry anchored to the old wall in such a way as to draw the center of gravity away from the front.

The Boston & Albany reports that when conditions exist which will not permit the use of buttresses or the encasing of the old masonry on the front, it has been found practical to remove the old masonry and rebuild the structure with concrete.

4. (b^1) The Lehigh Valley reports that when there is ample room in front of the wall, buttresses or a complete facing of the existing masonry may be necessary. But in most cases toe walls are required in addition to buttresses or facing walls, since the trouble in walls failing usually comes from the toe pressures on the underlying soil being too great for such soils to carry.

The Boston & Albany advises that instead of using buttresses, a casing of concrete of the necessary thickness is used. This latter depends on the condition of the abutment and the height. The facing of the concrete is reinforced with rods, spaced three ft. apart perpendicularly.

5. The Lehigh Valley reports that repairs to partially undermined abutments are usually made by underpinning with concrete, carrying a toe wall along the damaged part and facing the wall for a short distance up. When water is encountered, sheet piling and shoring are required, and the repairs should be made in short sections, so as not to damage the old wall further. Special care must be taken in sandy soil foundations, not to disturb the support under the wall by pumping.

The Chicago & North Western advises that when abutments are partially undermined, such as would be caused by a washout, traffic should be carried on false work, and repairs to the foundation should be made by putting a proper cofferdam in and then placing the concrete.

The Boston & Albany recommends underpinning with reinforced concrete, exercising proper care where work is done under traffic so as not to undermine the abutment and cause the loosening of stone in the structure.

The Boston & Maine reports an interesting case which occurred over a year ago, when, by the breaking of a dam, both abutments of a bridge over a small stream were undermined in some places to a depth of 4 ft., and in no place less than 2 ft. below the footing course. These abutments were supported by pile foundations. This pile foundation did not fail and the abutment did not settle to any extent. The problem which presented itself was how to refill under them, as the water in the river would not go down for several weeks. Sixty-eight carloads of rubble stone of various sizes and some crushed stone were placed in the front of these abutments. This filling was carried somewhat above the footing course. False work was then installed in the back of the abutment to carry traffic, and the material was removed to the bottom of the abutment. Steam pumps were installed on the bank of the stream, having a nozzle pressure of 200 lbs. A ¾-in. nozzle was made from

pipe, especially for this case, and about 30 carloads of sand were blown underneath each abutment until absolute refusal. These abutments have remained absolutely solid, are carrying their heaviest power over them, and show no signs of settlement.

The Great Northern cites a case of this kind in connection with a bridge near Corson, South Dakota. The bed of the river at this bridge was badly washed by a flood in June, 1914, the center pier being undermined so that it was necessary to take it down and rebuild it, carrying the footing to a greater depth. The west abutment was undermined at the toe, but did not move. This abutment was saved by underpinning at the toe with a block of concrete. This concrete was put in in short sections, so as not to disturb the footing any more than necessary. This work was carried out successfully, and no further trouble was experienced.

Near Ferndale, Washington, it was necessary to remodel the center pier of a bridge. This bridge contained a light steel draw span which had to be replaced with a heavier structure. This required a larger center pier. The work was accomplished by building a concrete jacket around the old pier.

6. The Lehigh Valley advises that when the strengthening of abutments is done, such work, if properly done in short sections, can usually be accomplished without supporting the superstructure carried by the masonry, but in very soft bottoms or in fine sandy soil, it may be necessary to place supports under the superstructure. When the strengthening is done in the rear of the abutment, it is necessary to drive piles and place temporary bents and stringers to carry traffic while excavating the embankment back of the abutment. The one case in which this method was employed, has given no trouble since the strengthening was done.

The Chicago & North Western reports that when repairs to piers and abutments are being made, it is almost always necessary to put in temporary false work.

The Boston & Albany maintains traffic by providing two four-pile bents as close to the back of the abutment as conditions will allow. These bents are driven as close to each other as possible, so that in case there are any broken piles in the first bent, the second bent will take care of them and another bent can be driven 12 ft. back of the double bent. If the abutment is to be removed, additional bents may be necessary. It has been found practical to use 20 to 24-in. "I"-beams temporarily, to carry the track on these pike bents, two "I"-beams being bolted together with separators under each rail. In front of the abutment 12 in. by 12 in. timber bents are used. The general practice is to use double bents with two batter posts and four plumb posts, double braced with 3 in. by 10 in. timbers. "I"-beams have been found more convenient to place under the tracks than timber, as they take up less room.

The Bangor & Aroostook maintains traffic by the use of pile bents where repairs to abutments are being made.

7. (No data.)

8. (a) The Lehigh Valley distributes the increased load of the superstructure on masonry. A good method, when possible, is to encase the existing masonry near the bearings, take out the bridge seats and enlarge them to reach over the encasement. This method also increases the bearing area of the soil. Where additional bearing is required on the top of the masonry only, this can usually be accomplished by taking off the coping stones under the bearing and placing a steel grillage or steel casting of sufficient size under the bridge to distribute the load.

The Boston & Albany has either encased the old masonry with concrete, or replaced it with the same construction to take care of heavier traffic.

The Delaware, Lackawanna & Western has, in most instances, found it desirable to take down all work to the footing, increase the size of the footing and rebuild the superstructure to the bridge seat. In one case recently, where it was necessary to raise the track on account of a grade crossing elimination scheme, it was found that the abutments did not have sufficient bearing and they were strengthened by reinforcing the toe.

8. (b) The Boston & Albany states that if the foundations are soft, piles are driven for the whole abutment, if the old masonry is to be removed.

9. The Boston & Maine states that this question covers some important work in tidal streams done by them. The rise and fall of tide is about 11 ft., the current approximately 14 miles per hour. Two piers 14 ft. by 60 ft., carrying 200-ft. truss spans, were built originally by placing a crib around a cluster of piles driven to a solid foundation and then filled with small stones. Then the entire section around the piers was grouted by dumping very heavy stone as well as smaller material to a depth of approximately 6 ft., leaving the water at low tide approximately 8 ft. deep. On top of this crib was built granite masonry. About two years ago it was found that worms had eaten the crib and the encased piling to such an extent that the masonry had settled and cracked.

Cofferdams were installed, which served as forms around each of the piers about 4½ ft. out from the piers at the bottom and running 3 ft. from the pier 2 ft. above the high water line. All surfaces were cleaned as thoroughly as possible by a diver, then concrete was placed until well above the old crib leaving pockets and chutes into the crib at intervals for the grouting of the old crib. This was done with a mixture of one part Portland cement and two parts sand. Approximately 140 bbls. of Portland cement were used in this grouting on each pier, then the concrete was built up to 2 ft. above high water and the forms were allowed to remain on the first pier through the winter season. But after taking these off, it was found that the concrete in the abutment was wasting away near the low water line, although this did not occur until after the forms were taken off. To offset this on the second piers, 4-in. hard pine plank casing was installed on the inside form with 1 in. by 12 in. lag screws screwed into the inner surface and allowed to project back into the concrete about 9 in. with pressed washers underhead. When this was completed, the forms were removed after suitable setting of the concrete. They have had no difficulty with the wasting of concrete on this pier, the casing extending below low water and to the high water line. Measurements have been taken from time to time, but no settlement has been discovered in these piers since this work was done. All of this work was done by company forces and cost, including all forms, diver, etc., about $8 per cu. yd.

The Baltimore & Ohio Western lines have done considerable repairing and strengthening of old masonry, but in many instances it has not been satisfactory. The old masonry in this territory was constructed mainly of very soft sandstone or limestone slabs. As reinforcement has not been very satisfactory, about 98 per cent of the masonry which has to be repaired or strengthened, is now being taken down and rebuilt.

Arches

The Delaware, Lackawanna & Western reports the failure of a number of arches during the past four or five years. These arches were built in the early eighties, and, in the main, are still unusually fine specimens of cut stone work. In some cases, failure has been due to lack of proper drainage and the action of frost. In most cases, however, there was very apparent evidence of overloading of the arch due to increased

weight of equipment. Where failure was caused by defective drainage and frost, it was not found feasible to drain the structures effectively, although conditions have been greatly improved by cutting holes in the masonry. Whether the failure was due to lack of drainage and frost or to overloading is not known, but all structures were lined with concrete of varying thicknesses, depending on conditions surrounding each job, and so far this method has proved very satisfactory.

The Pennsylvania Lines west of Pittsburgh report that extensive repairs have been made to arch bridges on the Pittsburgh division, some of which were built as early as 1852. On some of these arches, as originally built, the parapet walls were given 6 in. projections for a depth of three courses to provide sufficient width for the track. The action of frost and ice pushed these walls out, making the structures unsafe for heavy equipment. A number of these structures were strengthened by encasing the old bridges completely in concrete, carrying foundations to rock and adding wing walls where T walls were built originally. These bridges are standing up under increased traffic, giving the best of service, and so far, none show any defects. It is therefore felt that this is a most satisfactory method of prolonging the life of arches where the waterway is sufficient to allow encasing them. The cost of concrete work of this character, exclusive of reinforcing material, is about $12 per cu. yd.

The Great Northern reports the strengthening of its stone arch bridge over the Mississippi river at Minneapolis, Minnesota. The structure consists of a series of 80 ft. semi-circular arches, and was built in 1883. Considerable care was exercised in its construction, with a view to getting a permanent structure. It is located just below the Falls of St. Anthony, where the line passes through the main milling district of the city. Several serious longitudinal cracks developed in the arches from time to time, which made it necessary to give this structure careful study, with a view to determining the cause, and devising some plan to overcome the trouble. The conclusion was finally reached that the failure was due to insufficient drainage which permitted the rock filling to become filled with water, and that the cracks were the result of water freezing and spreading the spandrel walls. Openings for drainage were provided through the parapet walls. Tie rods were provided extending entirely through the structure together with anchor rods extending into the structure a distance of 10 ft. The rock filling above referred to, was removed and the space filled with concrete. No further defects have developed since this work was done.

The Lehigh Valley reports a few cases of defective stone arches, in which the form of the arch was considerably distorted and the ring cracked. These arches were repaired by constructing new foundations, side walls and arches inside of the defective structures. While the placing of the arch ring lining is a tedious job, it can be done successfully if a comparatively dry mixture is used, so that it can be packed thoroughly in place. The sections for the lining of the arch necessarily have to be short, so as to be reached from the ends of each section to be able to compact the concrete properly. The work that has been done has proved satisfactory. While no costs are available, the work is expensive on account of having to provide centering, sheeting, etc., the same as for a new arch.

The Chicago & North Western reports that where parapets and wing walls of old arches have become disintegrated, repairs have been made by removing the upper courses and replacing them with concrete. In making repairs in this manner, the concrete was bonded to the old masonry by rods.

The Boston & Albany has furnished the following detailed cost data covering the replacing of a stone arch with concrete:

Unit Cost: Driving piles (598 ft.)

Labor, etc.	$0.284	
Material (598 ft.)	0.0987	per ft.
Total,	$0.3827	per ft.
Stone masonry removed (77 cu. yd.),	$2.968	per cu. yd.
Wet excavation (50 cu. yd.),	$2.151	per cu. yd.
Earth excavation (108 cu. yd.),	$1.298	per cu. yd.

Concrete (124 cu. yd.)

Material,	$ 441.15	$3.557	per cu. yd.
Labor,	850.79	$6.861	per cu. yd.
Total,	$1,291.94	$10.418	per cu. yd.

Cofferdam (75 lin. ft.)

Labor, etc.,	$4.48	per lin. ft.
Material,	.17	per lin. ft.
Total,	$4.65	per lin. ft.

Forms (2,210 sq. ft.)

Labor, etc.,	$0.0301	per lin. ft.
Material,	0.0257	per lin. ft.
Total,	$0.0558	per lin. ft.

Also detailed data of encasing a brick arch where the bricks were working loose, as follows:

Handling material,	$ 98.53
Engine service—handling material,	38.93
Excavation, wet (130 cu. yd.)	304.65
Reinforcing rods in place.	139.72
Concrete, Class "A" (128 cu. yd.),	691.85
Cleaning up old material removed,	11.50
	$1,285.18

Average cost per cubic yd., Excavation,	$ 2.34
Average cost per cubic yd., Concrete,	5.40
Average cost per lin. ft., Arch,	10.19

This structure was lined with concrete an average thickness of one foot, reinforced longitudinally and transversely with ½-in. twisted bars, located 12 in. center to center. In addition to the reinforcement, ¾ in. by 12 in. dowels were set in the old masonry a depth of 6 in. at intervals of every 5 sq. ft. of surface.

Retaining Walls

The Delaware, Lackawanna & Western reports the partial failure of retaining walls on its lines, both of plain masonry and reinforced concrete. Special mention is made of a reinforced wall 20 to 25 ft. in height, in which, owing to various causes, certain portions were verging rapidly on total failure. The method employed in making repairs was to cut out short sections at a time, bulkhead behind them with second-hand timber, clean the reinforcing where necessary and replace the walls. Other forms of walls were repaired or rebuilt in much the same manner.

The Chicago & North Western reports that where old masonry retaining walls have been crowded forward, some good results have been obtained by driving piles in the embankment and anchoring the retaining walls to the piles by means of rods.

The Boston & Albany reports four retaining walls over 200 ft. long and from 16 to 18 ft. high, running parallel to, and very close to the tracks, which showed signs of failure. These retaining walls were

strengthened by the use of concrete facing, bonded to the old masonry by 18-in. dowels, spaced at intervals of 4 sq. ft. of surface. The old foundation was from 6 to 12 ft. below the river bed, and in places badly undermined. It was necessary to underpin the old walls, and this was done with reinforced concrete. While underpinning the foundation, it was necessary to shore with 10 in. by 12 in. and 12 in. by 12 in. timbers. While this work was in progress, speed was reduced to 8 miles per hour for all trains. This method for strengthening retaining walls has put them in first-class condition. The tops of the old walls were removed for a depth of 24 in. and replaced with concrete, thus bonding the old masonry and concrete on top as well as on the face.

The Boston & Maine reports having had experience in repairing retaining walls by use of buttresses and grouting at the same time. One case mentioned covered a retaining wall along a river under an important line where the track was close to the edge of the wall. This wall was built of rough ledge stone that had deteriorated to such an extent that in some places there were openings in the wall of a cubic yard volume and larger. As this wall rested on a sloping ledge foundation, 2 in. iron dowels were installed in the ledge in front of the wall and the foundation built approximately 1½ ft. in front of it. Great care was used in removing all dirt and debris from the old masonry as the work progressed and concrete was carried to the top of old wall, being 1 ft. thick at the top. This wall was reinforced about nine years ago, and has shown no signs of failure since. Openings were provided through the concrete at intervals from the bottom of the wall to within 18 in. of the top of the wall to take care of the drainage.

The Baltimore & Ohio has found it necessary to strengthen retaining walls at points along its lines. The most extensive work of this character in recent years was the strengthening of a wall about 20 ft. high, located between the C. & O. canal and the main tracks of the railroad. This was a dry rubble wall of fairly good sized stone. On account of the increase in weight of rolling stock, this wall began to show signs of failure. About three years ago, a section between 400 and 500 ft. long was strengthened by building a reinforced concrete wall in front of the old wall. This past winter, 1100 or 1200 ft. additional reinforcing was done. The concrete placed several years ago was heavily reinforced, and as a result, was quite expensive. The section reinforced last winter consisted of plain concrete. It was necessary to do this work during the winter when the water was out of the canal. At several points where the wall seemed weak, timber braces were placed against it. The foundation excavation for the new wall was removed in 10-ft. alternating sections and was filled to a point that would afford ample protection to the base of the old wall. The intermediate sections were then removed, after which the superstructure was built in sections about 40 ft. in length.

W. F. Strouse,
Chairman.

DISCUSSION

The President:—As the reinforcing of old masonry happens to be quite a hobby with me, I am going to take a little time to recite some experiences I have had.

About ten years ago when I took over the bridges on the Missouri Pacific system I found a good many of the old lines had been handled by promoters, and the bridges in many instances were in very bad condition, and every year there were

large items for new abutments and rebuilding of old masonry, and something had to be done. I spent a good deal of time out on the line trying to find out what could be done at the least expense and still make the repairs permanent.

We found on some of the old main lines where stone piers had been built 30 or 40 years ago for pony trusses, that the piers held up the pony trusses all right, but when the bridges had been renewed either with pony steel trusses or deck girders for heavier traffic, the ends of the piers would settle down or the middle of the piers would break down. As a temporary expedient in those cases I used an idea that I had gotten from some old bridge man of putting longitudinal timbers from end to end of the pier. That had the effect on the piers under the pony trusses of throwing towards the center some of the load that was settling down the end of the pier, and under deck girders of throwing out to the end of the pier some of the load that was breaking down the middle. That was then followed up, sometimes several years later, by taking down one or two courses off the top of the pier and putting in a new reinforced concrete cap, and I don't know of one case in 10 years on that railroad where I took down a few courses from the top of the pier and put in a reinforced concrete top that would distribute the load over the pier, where we had any further trouble or any further settlement.

We also had cases where the back-filling of the pier behind the casing was very soft and was breaking down under the loads. We ran tie-rods through such piers and put a casing 6 to 9 in. thick on each side, and we had no further trouble there.

One lesson I learned there was the remarkable bond that forms between new concrete being placed, and old masonry in those piers, even though the old masonry may be moving at the time of placing the new concrete. The first question I was asked was, " How is this concreting to be placed while the bridge is in use and the old masonry moving?" Now in practically every instance we concreted while the old bridge was in daily use, and even though there was a considerable movement of the old pier, the new concrete set firmly.

This set is really remarkable. Perhaps the most extreme case where a movement has been stopped and the concrete has set was on the long approach to the St. Charles bridge over the Missouri River on the Wabash railroad. There is a long curved approach there, and trains going around the curve would throw

the track out of line sometimes as much as 6 in. The chief engineer of the Wabash finally struck upon the idea of changing these old columns into concrete columns. He put an 18-in. form around them and wound them with wire and rods and built the columns up from the bottom, story by story, from the bottom to the top. When he was a quarter of the way up, one-quarter of the lateral vibration had disappeared, and when he was halfway up one-half of the lateral vibration had disappeared, and when he got to the top the lateral vibration had entirely disappeared. That concrete is apparently just as good as though it had been placed under a bridge that was perfectly still instead of one sustaining a heavy traffic.

Another case I found at Little Rock, Ark., where a bridge across the Arkansas river had piers made up of about 35 ft. of timber cribbing and 45 ft. of masonry on top of pneumatic caissons on rock. The cribs were not really well built in the first place and the sand had leaked out through the cracks. The timbers gradually had crushed and let those piers down, and they were pointing in every conceivable direction. From 1883 until about 1907, when I took over the responsibility for the bridge, I think about five efforts had been made to stop those piers from moving around.

In 1912 we went in and sunk cofferdams about them, went down to a depth of 45 ft., removed all the sand and rip-rap, and while those piers were moving around a good deal, we gradually put in concrete and began to build up, and as the concrete went in one could almost note the disappearance of the vibration. When we got up to the top the piers were solid. When trains went over before, the timbers were soggy, and you could see the water squeeze out of them. When we reached the top of the timbers we put a reinforced concrete shell around the piers, and those piers have been there now for five years and they are just as solid as rock.

In 1907 I had 150 bridges on that railroad under which the piers were moving, for every conceivable reason, and I don't remember one case where we took down a pier or abutment because it was moving. In every case we resorted to some of the expedients reported by Mr. Strouse, and we never hesitated, even on a smooth concrete face of an abutment, to drill in, put in anchor rods and put the shell in front of that.

We had another case where we encased some steel cylinders

in concrete. We had a number of piers, each composed of two steel cylinders, and each having seven piles driven down through the cylinders. We wanted to put a heavier truss on and we had to reinforce those cylinders some way. Without any falsework at all we went down around those cylinders, drove the piles to about 40 ft. penetration by the jet, put the cofferdams down, and came right up around those cylinders and buried them in concrete.

When we jetted a pile down at one side of the cylinder, the cylinder settled about half an inch, so we would drive so many piles on one side and then go around and drive so many on the other side to keep it from getting too much on one side or the other, and when we got through we found the cylinders, every one of them, had gone down about 12 to 14 in. The mass of concrete was so great in comparison to the size of the cylinders that the weight of the concrete overcame the motion as it came up on the cylinders which were vibrating under traffic.

In a number of cases we had concrete arches built for one or two tracks. Sometimes the head-walls were pretty well out at the foot of the slope and pulling away. Now in three cases I remember distinctly, I put across the head-walls, about 3 ft. below the crown, a pair of heavy I-beams, and ran rods through from one set of I-beams to another. On one bridge we were sure we were going to lose immediately, we spent about $3,000 putting in a set of I-beams and a set of rods five years ago. I took a trip there recently and there has not been a particle of motion since we tightened up the rods. It is as stable as though it had been built right. Nobody sees the arches but the bridge inspector, and he doesn't care, so the appearance does not matter. To have rebuilt the arches would have cost $50,000.

Now I hope there are some others here who can say something on this subject. I know some of you have had experiences on this that will put all I have had in the shade.

A. S. Markley:—The Chicago & Eastern Illinois had four through truss spans, each 150 ft. long, and one 166 ft. plate girder draw span crossing the Wabash river at Clinton, Ind. The masonry supporting this bridge was built of native stone in 1870. The stone had deteriorated and began to show defects under the truss bearings on account of the heavy live and dead loads. For this reason it was decided in 1910 to strengthen all the five piers, the south abutment and tail wall and a detached tail wall

and to build an additional abutment for a 24 ft. beam opening to replace a wooden trestle for an under crossing for teams at a total estimated cost of $19,490.

The actual cost of this work without overhead charges on car rental was $20,850. During the work the operator was interrupted twice by high water and once to do other important work, which no doubt absorbed the overcharge. Work was begun in September, 1910, and completed in September, 1911, the cost per pier ranging from $3,019 to $2,638.

All of the masonry in the old piers and abutments was veneered with reinforced concrete 18 in. thick.

Cost of concrete per yard for casing:

Material, per yard of concrete	$ 1.84
Labor, per yard of concrete	1.49
Total	$ 3.33
Cost per yard of concrete, labor	6.49
Cost per yard of concrete, material	4.40
Total cost of labor and material (casing included)	$10.89

In order to take care of the additional dead load of the concrete, 30-ft. piles were driven 36 in. between centers around the outside of these piers and the abutment, the latter being 30 ft. long and 42 ft. high from base of rail to low water mark. In driving these piles the leads and steam hammer were suspended below the bridge, a Bay City driver and steam hammer being used. A short boom derrick with a 2-drum and winch-head machine was placed on the front of the driver to handle the leads, hammer and piles. The driver was self-propelling, dispensing with a train crew and locomotive. All piles were driven home to receive the concrete and below low water line. Double rows of the sheet piling were driven around the piers and 2½ ft. away from it, the space between being filled with straw and sand to insure that there would be only dead water inside of the cofferdam to avoid any cement flowing away. The inside casing of the cofferdam comprised the form for the concrete which was placed a minimum thickness of 4 in. outside of the piles, so that no part of the piles was exposed to the atmosphere or other destructive agents. The water around the piles was from 8 to 12 ft. deep. In some cases the piers had been filled around with

broken stone to prevent washing, which very much impeded our work of driving the sheet piling.

In order to deposit the concrete in the water we used a 10-in. tube made of No. 22 iron, riveted together with a barrow hopper at the top in which to dump concrete from barrows into the tube. In using this it was necessary to seal the tube on the bottom or keep enough concrete in it to prevent the water from rising in it and separating the sand from the concrete. As the tube was filled it was moved to one side or raised sufficiently to allow the concrete to pass out of it in place.

The concrete was allowed to settle around the piles and make its own slope from the inside of the sheet piling down under the pier. In some cases there were openings that took considerable quantities of concrete to form the footing up to the grillage, all of which added to the support of the increased dead load. The piers in all cases rested on piles and grillage. While this work was going on, no discoloration of the water inside the cofferdam was visible, the cement and other ingredients remaining where they were deposited. These footings, in some cases, were 2 to 3 ft. wider than necessary to support the 18-in. veneer on account of the grillage being wider than the piers. In these cases we stepped in to the required width. The upper forms rested on and were anchored to the footings and were tied at the top to prevent their spreading as concrete was deposited in the forms. In order to anchor the concrete to the old piers, ¾-in. corrugated bars were placed 36 in. apart. Holes were drilled in the stone 12 in. deep in which the bars were inserted. They also extended 12 in. into the concrete. After dampening the holes a rich mortar was packed in them around the bars to anchor them to the pier. In addition a dovetailed recess was cut in the stretcher course of masonry for the full thickness of the course, from 18 in. to 24 in. thick and as deep as the stone was wide. Stretchers were selected on account of their being narrow to minimize cutting. After the recesses were cut, concrete was brought up and an extra thin grout was run into them to fill up the voids that appeared in the masonry, which were many and some quite large. As the stone was laid in mortar, where recesses were not opposite each other, grout would appear on the opposite side from which it entered the pier as the grouting progressed. The veneer was properly reinforced in both directions in addition to being anchored to the pier.

Bearing blocks under the trusses on top of the piers were made in the field and were properly seasoned before placing. The joints in the masonry always determined their thickness, the minimum being 4 ft. thick and 24 in. wider than the shoe of the truss. Parallel with the track the blocks extended 12 in. on to the veneer on each end, leaving 6 in. of the end of the block to be covered up with veneer so as not to show the joints of the block on the face of the pier. All these blocks were heavily reinforced and placed under traffic, using a self-propelling derrick to place them. All work done at this time is as perfect as when completed, no blemish whatever having appeared. At the same time new coping was added to all the piers and abutments. At several other double track truss bridges we have had this same defect, bearing blocks replacing the old stone piers where evidence of defects appeared. We have usually coped the entire pier or abutment down in some cases as far as two courses below the coping. We use two 50-ton ratchet jacks under one end of each span with loops made to fit over the nuts of the end pins with stems sufficient in length and strength to carry the weight crosswise of the track. Heavy timber or I-beams were used on top of the jacks to raise the trusses. The stem of the loop passed through the timber with nuts and a plate on top or between the beams.

We had two 12-ft. arches with 6-ft. bench walls in which the stone had deteriorated to such an extent that it was necessary to strengthen them. The barrels of these arches were 45 ft. long. In one we placed reinforced concrete 12 in. thick. In order to place the concrete, which was made reasonably thin, we tapped a hole 24 in. square in the crown of the arch between the two main tracks and outside of the ties in which to pour the concrete, beginning in the center and using 1 in. by 6 in. plank to tamp the concrete in place between the corrugated bars.

At the second arch we used three rings of paving bricks made of ground shale beginning in the middle with centers 30 in. apart or sufficient for men to work between. As the brick was laid in the crown roller ways, the lagging was placed in sections, keeping the brick in reach of the men laying them. As both arches were duplicates we saved $150 by using brick which cost $12 per M. In laying the brick, very thin cement mortar was used. When the brick were "buttered" they would be slid 12 in. to 15 in. on the mortar bed into place, thus insuring

a perfect joint. The space between the old and the new crowns was backed up with spaces of brick and mortar.

We have four or five brick arches which were built in 1896. Upon recent inspection they were found to be as perfect as when put in, except the footings of concrete. There is no leaking of the roofs or bench walls. They were coated over the top with a rich mortar 2 in. thick at the time they were built. No extremes of temperature or combination of freezing and thawing of water have had any effect whatever on their durability.

G. M. Hoffman:—The Philadelphia & Reading has a 14-span Phœnix bridge across the Susquehanna river, in which the piers were giving away below low water. Nobody wanted to undertake the job of fixing them. Finally a mason foreman said he could do the job by digging down in sections, propping up the old stone, and putting in concrete and stone in about 16 sections across, while the traffic was moving. It was an unusual piece of work. Each pier was estimated to cost $4,000 but the Reading people did the work for about $2,000 a pier. After each pier was done we ran a lining of about 18 in. around it from low water up to high water. They are just as good today as the day they were built.

R. H. Reid:—Along the line of reinforcing or repairing masonry, we recently had a case where the waterway through a stone arch culvert had to be deepened. It was a culvert built about 50 years ago under an old part of the road. On account of drainage conditions it was necessary to deepen the waterway something over 6 ft. through the arch. The arch was paved and was about 80 ft. long, extending under four main tracks. We underpinned that culvert this year, taking out the paving, underpinning the entire arch, lowering the bottom 6 ft. and putting the paving at that depth. We have just completed the job, with no evidence of cracking or settlement in spite of the fact that it is under very heavy traffic.

We have had many other cases where we have underpinned abutments and piers, and in some cases large arches, with very good results. We are just finishing underpinning a pair of abutments now on one of our branch lines near Fort Wayne. We went down about 4 ft. and underpinned both of the abutments, on account of the lowering of the stream.

We had another pair of abutments about 12 years ago, that were crowding in at a point where the bottom was very soft.

There were three sets of timber bracing between those abutments but they began to show evidences of failure. It was no use to put any more bracing in for the same thing would happen again in a few years, so we decided to underpin both abutments and reinforce them to prevent them from crowding in. We went down 8 or 10 ft. and underpinned both of those abutments, putting enough concrete in front to reinforce them, and we have had no trouble since that time.

On another part of the line some concrete piers that were not properly built in the first place (either the inspector or the contractor, or both perhaps, not being on the job as they should have been) showed evidences of disintegration. We have had to dig them out and replace the concrete under traffic. In some places we took out the pedestals, carried the deck girder spans on I-beams resting on either side of the former bearing point, and put in the concrete, then removed the I-beams and put the pedestals back in place. In other cases we dug out the concrete, put in I-beams and carried the girders on them while filling in around them with concrete. In other cases we riveted one girder to the end of another and carried it in that way.

In still other cases we have excavated below the poor concrete, dug out from under the piers and abutments, taking out all we dared, surrounded them with good concrete and encased the entire top of the pier. In cases where the whole abutment showed evidences of failure, we have carried the girders on falsework, removed a part of the abutment, replaced the concrete and capped the abutment. We have been doing a good deal of that work lately on parts of our line where the masonry is old and not built properly in the first place, some of it being built before we acquired those lines.

PAINT AND ITS APPLICATION TO RAILWAY STRUCTURES

REPORT OF COMMITTEE

To discuss this subject intelligently it is not of as much concern to consider the structure itself, as the material of which it is constructed, and the surface to which the paint must be applied, either for preservative or decorative purposes or for both. From the standpoint of present day construction we can divide railway structures into four classes: (1) wooden or frame structures, (2) brick and stone structures, (3) steel and steel-covered structures, and (4) concrete and stucco structures, although occasionally we may find one put up of any combination of the above.

From the railway standpoint, we generally separate these structures into station and office buildings, dwellings, tool and car houses, shop buildings, coaling and fuel stations, etc.

Wooden and Frame Structures

This class requires the greatest amount of attention and expense, for the only practical method used today to protect these buildings from decay or to improve their appearance is to apply a preservative coating of high grade paint. Aside from the decorative effect the most important function of paint is found in its preservative properties. Unpainted wood will darken, warp, become fuzzy and damp and finally decay, but it may be protected from such forms of decay permanently through the occasional use of high grade paints. Paint acts as a preservative on wood because it closes the openings and pores in the wood and so prevents the entrance of decay-producing organisms. A thoroughly seasoned piece of wood will last indefinitely if kept well painted. This fact, however, is too well understood to require further discussion and we may concede that money spent for painting is "money well spent." Aside from this, an attractively painted railway structure adds a great deal to the general appearance of the road, thus making it an economical advertisement.

The quality and the kind of lumber used in the different structures varies, of course, with the different sections of the country, being governed principally by the type and kind grown in those sections traversed by the individual railroad. The principal woods generally used for siding, outside trim, etc. (i. e., on those portions with which our discussion treats), are usually produced from the softer types of wood, such as white pine (although this supply is diminishing rapidly), hard or yellow pine, poplar, basswood, Oregon cedar, redwood, cypress and spruce.

Gum, white, red and Washington cedar are also used more or less for the purposes mentioned. We are not endeavoring to discuss the merits or demerits of the various kinds of wood, except as they relate to the application of paint as a foundation. Let us bear in mind that these different species and types of woods vary greatly in their make up, porosity and compactness, all of which are important points which are very often lost sight of when the initial or first coat of paint is applied. This operation is commonly called priming. For instance compare white pine and poplar with yellow pine and hemlock—the first being

soft, close and straight grained, even woods, comparatively free from shrinkage, possessing good absorbing qualities and a ready affinity for paint on account of their even and uniform grain, while the latter are hard, coarse grained, of very resinous and uneven structure, varying from a soft porous and quick absorbing, to a very hard and fat surface into which paint can not penetrate. Thus we can readly see that a mixture of proper consistency and balance for the one can not and will not produce the same result in the other, if used in identical ways.

Explained from the practical standpoint, the first requires that the priming coat should be reduced to a medium thin consistency, carrying very little turpentine, or just enough to assist penetration and brushing. In the second instance a thinner mixture carrying from 25 to 40 percent of turpentine should be used. In the first instance successful two-coat work can be obtained, while in the latter case the two-coat work can not be recommended as thin coats are absolutely necessary to insure depth of penetration or binding. Three thin coats, well brushed out will not leave an excess of paint on the surface, while two coats which would necessarily have to be heavy, in order to hide or cover the surface evenly, may break away or scale in a short time. However, if for any reason two-coat work is desired, the liberal use of turpentine in the priming coat is recommended, as well as ample drying time between coats. The priming coat should be applied with a full brush, and spread out well and evenly. Do not allow the brush to slip over the hard places, but work the paint well into them. Extra care should be taken in brushing over this surface in order to even up the priming and not have too much pigment on the hard parts.

We now reach the point, which is sought to be conveyed from the foregoing. Nearly every railroad has adopted a certain standard of painting, both as to method and colors, including the formulas composing the different mixtures. These mixtures, or "standard colors" are usually bought in the open market, although some concerns have "paint mixing departments" of their own. In a great many cases this material is bought "ready application," leaving no room for adjustment to fit the different surfaces, and of course it is applied in the condition in which it is received. Or on the other hand, incompetent or inexperienced men who neither know nor care what they are doing, are applying the material in any old way and manner and when trouble develops later, the question is "Why?" Such a condition is generally found on railways where carpenters and bridgemen unfamiliar with such work take care of the painting.

Priming

The act of priming or first coating is the most important operation in painting, although in many cases it is not so considered, which is a vital mistake. The priming coat applied to any surface must fill and satisfy this surface, and create a foundation upon which **all** future coats can be applied successfully. It holds the same relative position in painting as the foundation of a house or bridge does in construction. It must last and hold the superstructure as long as it remains. It must carry sufficient linseed oil not only to satisfy the surface, but also to bind and hold the pigments to this surface. Priming mixtures must also carry the proper amount of turpentine to cause penetration and assist in forcing the oil and pigment into the surface by absorption. The formation of the pigment must be such as to allow penetration into the surface, and above all, it must be well and evenly spread and brushed into the surface. It is of course impossible to erect a frame structure, and have all of the lumber of the same absorbing qualities. The sapwood absorbs paint more rapidly than the harder-grained portions. However, this does not necessitate a different reduction for each kind of grain in the same lumber, but it does require proper judgment on the part of the painter in **correct application** to such a varied surface. In

priming soft wood, the paint should be applied with a full brush, and enough paint used at all times to satisfy the surface. It should be well brushed, especially on the harder grain, in order to force the paint into this close grain, and so remove, by diligent brushing, any surplus paint that remains on the surface. On hard or close grained wood a medium full brush should be used in application, for this class of wood does not possess the absorbing properties of the softer kind, and therefore requires more brushing to force a sufficient amount of oil and binder into the wood and at the same time not leave an excess of paint on the surface. If the priming coat is of the proper consistency, carrying sufficient pigment to fill and hide the grain, and is well brushed into the grain of the wood, most of the absorption will have ceased with this coat, and no excess of pigment will be left on the surface. This thin coat will then allow the next coat to penetrate through and satisfy any part of the wood which was not fully filled at the time of priming, and will also allow the second coat to bind itself to the wood and combine with the priming coat.

An excess of paint on very porous woods will cause peeling or chipping, for this heavy coating prevents the oils from penetrating the wood and then fails to assist in holding the coat on the surface. The oil and binder in the second coat penetrates into this heavy coating only, and does not reach clear through into the wood to assist in forming one solid film, well anchored to the surface.

Paint, heavily applied to a hard or close-grained surface, will dry with a gloss, forming a hard glaze over the surface, into which the second coat cannot penetrate to any depth, and will only fasten itself to the outside of this hard glaze coat, whereas it should go clear through to the wood in order to help anchor the second or subsequent coat. The prime coat should not stand longer than is necessary to harden the film thoroughly, and allow for full absorption and penetration. If allowed to weather, this priming coat will become porous and absorb the life of the second coat and there will not be sufficient binder left to adhere to the surface properly.

The foregoing demonstrates plainly that the man behind the gun, in this case the painter, must do his bit by exercising good judgment and proper skill both as to material and labor in order to turn out successful work. The conscientious, capable and careful workman will exercise at least as much if not more care and skill in the application of the priming coat, than he will with the finishing coat.

Finish Coats

Usually railway standards and specifications stipulate whether two- or three-coat work is desired, but it should be borne in mind that in trying to finish in two coats over dark, hard and pitchy lumber, especially with light shades, success at some future time may be sacrificed. In the second and finishing coating of structures, care must be exercised in spreading the paint evenly and clean and in avoiding sags and curtains.

Brushing

Proper care and knowledge in brushing is as necessary as good paint for successful work, for on the working or brushing of the coat rests, to a great extent, the success of the material used, regarding wear and durability in its protection of the surface to which it is applied. It is a fact that the best material, in the preparation of which great care has been exercised, will not give good results if it is improperly applied.

Paint loosely applied and flowed on to the surface, will not bind to it, neither will it dry or harden properly, and a coat of paint not properly bound to the surface over which it is applied, will be found hard

and dry on the outside and still not evenly hardened throughout. Considering the entire matter, it is evident that the right kind of mechanics should be employed, for practical experience embodies the proper skill and knowledge so necessary to success.

Shingle Roofs

Shingle roofs, at least on the better class of buildings, ought to be painted with some high grade material, not only to preserve the roof itself but to improve the appearance of the structure as well. Moreover, a valuable characteristic of high grade paint is its resistance to fire. While the oil content is more or less combustible, there is present in the dried paint film a minor proportion of oil, the major portion consisting of metallic and mineral pigments which are unaffected by fire. The content of pigment varies from about 50 per cent to 70 per cent. The application of paint to roofs will preserve them for a number of years and render them more resistant to fire, making it an inexpensive form of preservation insurance.

Paint

This is really a subject of itself so it is not necessary to enter into a discussion of it here, for it is usually covered by the standards prescribed on each railroad. However it may be well to call attention again to the importance of procuring the material heavy enough, in order to give the mechanic a chance at its proper reduction to insure correct manipulation for the several coats, both for new work and for recoating over old films.

Brick and Stone Structures

With the exception of window and door frames, sash, doors, gutters and down spouts, no painting on this class of structures is really necessary. The method and the color are generally covered by the standards in vogue on each system. If, however, it is desired to paint the brickwork, etc., the usual rules will govern the operation.

Steel and Steel Covered Structures

On this class of structures, the primer or first coat must be selected judiciously. If the standard finishing color for these structures should happen to be of a carbon or lamp black base, it would be positively wrong to use such a paint for the ground coat applied directly upon the steel. This primer should be a properly-prepared rust-inhibitive coating, from basis pigments such as red lead, sublimed blue lead, oxide, chromates or similar inhibitive materials. After proper drying time has elapsed, carbon or other standard paints may be applied successfully. Over such a ground practical tests have proven that ultimate economy is effected by using only the highest grades of the proper kinds of paint for metal protection.

Cement and Stucco Structures

Structures of this class are of more recent origin than the others, and it may be some time yet before paint will be extensively used on them. But at some time this type of railroad structures will receive attention to a greater or lesser degree by the application of paint. Owing to the limited time, this committee has not been able to work up data of actual experience on railway structures to date, but will quote briefly a well known American authority who has conducted numberless tests in all its phases along this line, Mr. Henry A. Gardner.

"Portland cement is used for numberless types of construction from concrete factory to the stucco dwelling. Its strength and durability are, however, offset by its unpleasing appearance, especially during stormy weather, when it absorbs large quantities of water and becomes mottled and streaked. At such times the interiors of concrete buildings are apt to become damp and cold. The rough exterior surface will receive and retain particles of dust and soot deposits from the air.

"When paint is applied to a concrete structure the exterior pores are filled, and a smooth, rubber-like film results that prevents the admittance of rain. This alone should constitute sufficient reason for painting cement constructions in every locality. The dust-resisting properties and the ornamental character of painted cement should be the further consideration wherever there is civic pride.

"Fortunately paint will wear upon cement for as great, or even greater periods than upon wood or iron, provided the paint is applied when the cement is dry. Moreover, the same paints that give good service on wood may be used successfully upon cement."

From tests and experiments made for a number of years it appears that high grade composition linseed oil paints with lead, zinc and inert bases are giving excellent results on concrete. That being the case, practically the same rules as given for the other types, should govern here with but few minor changes.

Chas. Ettinger, Chairman.

DISCUSSION

A. S. Markley:—I would like to ask what is meant by sags and curtains in paint.

C. Ettinger:—That is a technical expression. Suppose a girder sags, you know what that means. A curtain is what they call a run with another run below that—stuff thrown on and left to run.

L. Jutton:—Will the heating of paint assist in its penetration of wood?

C. Ettinger:—It all depends on weather conditions and on the surface. You should not heat the paint for you destroy the most valuable article you have in it—the oil. It is a well-known fact that the most valuable ingredient of paint is the oil; pigments alone do not wear.

A. S. Markley:—Isn't the oil giving away much of the cause of paint peeling off?

C. Ettinger:—No, there are a number of reasons why paint will peel off. In 95 per cent of the cases it is due to improper judgment on the part of the mechanic, or to the material; or it may be partly due to the priming in building the foundation. The reason that I want to bring this home to every railroad manager is that paint is usually bought in the open market, and is usually ready for application, giving the painter absolutely no chance to manipulate the paint to suit the foundation to which

he must apply it. Now, you use a good deal of yellow pine on your road, don't you?

A. S. Markley:—Yes, pretty near all yellow pine.

C. Ettinger:—Well, there is a great deal of pitch in it and there will be very little absorption,—the surface being so fatty. That timber contains a great deal of resin and pitch. All such woods as that require special manipulation both by reducing the paint properly, as well as by proper brushing. You have got to work it in. It will not anchor to the wood if you don't. Then, paint shrinks in drying. The moment it shrinks, it pulls away from the foundation, and later, when the oils have gone, it cracks open and finally drops off. That is what we call peeling.

A building ought by all means to be permitted to season before the painter goes to it, but everybody knows that no one considers the job completed until it is painted. When the carpenter is through the painter must be right behind him. This is absolutely wrong.

G. M. Hoffman:—Do the same conditions exist on buildings away from the railroad as they would along the railroad with reference to painting? You do not have nearly as much soot to contend with on a building away from the railroad, while a building near the road will be covered with it. Is not that harder on paint?

C. Ettinger:—Yes, the gases contained in the smoke are the hardest on paint of anything you can find.

G. M. Hoffman:—How often do you paint your buildings along the railroad?

C. Ettinger:—All the way from three to six years.

G. M. Hoffman:—How many coats do you put on?

C. Ettinger:—That depends upon the wood and the color, but by no means should one-coat work be done. I don't believe in one-coat work, for the reason that in order to have any kind of an appearing job you have to spread the paint so very heavy to cover it. You have a good deal of oil and no binding and this leads to a separation between the old paint and the new.

G. M. Hoffman:—Fifty per cent of the railroad buildings, or buildings along the railroad, don't need painting, just cleaning. But when you start to paint a railroad building what would you do first?

C. Ettinger:—Well, the cleaning method generally used is to just dust it.

G. M. Hoffman:—You wouldn't wash it; wouldn't try to get the black dirt off? Would you expect to get good results from that, putting the paint over the soot and grease?

C. Ettinger:—Yes.

G. M. Hoffman:—I don't agree with you. Every two or three years we go along the division and clean the buildings, making a general cleanup. If a building needs washing, we wash it and scrub it and then paint it. If one coat will do we give it one, and if it needs two, we give it two, but it is very seldom we give it two coats. I claim that paint won't hold very long on grease and soot.

C. Ettinger:—If you use a sufficient amount of turpentine, it will penetrate the soot, and make the best paint out.

THE ECONOMICAL DELIVERY OF WATER TO LOCOMOTIVES

COMMITTEE REPORT

Strictly speaking, the economical delivery of water to locomotives includes every operation involved in handling the water from the source of supply to the locomotive tender, but for the purpose of this paper it will be interpreted to include only the delivery of water from the storage or roadside tank to the tank of the engine.

Water is delivered to the tender of a locomotive either directly from a storage tank or through a pipe line and a discharging device, commonly called a water column, standpipe or penstock. In the early days of railroading water was delivered direct to the engine tenders from the pumps, which were chiefly operated by hand by switchmen or other employees when not engaged in other duties. Later horse power was employed and in time storage tanks of small capacity were constructed and water was delivered to locomotives through leather hose or boots, as they were then called. Metallic and rubber tank fixtures followed and finally the sway spout and tank valve came into use. Many different types of spouts and fixtures were evolved, none of which can be said to give entire satisfaction, even to the most improved tank fixtures of today.

The earlier types of tank spouts were fitted with ball joints and also with rubber hose connections. These fixtures were a continual source of annoyance and expense, especially in the colder climates where they gave much trouble from freezing. Spouts of more simple form were then devised, the spout being considerably larger than the goose neck or outlet pipe, which permitted a more liberal water passage and overcame the necessity for a water tight joint between the outlet pipe and the spout. This type of spout was also more simple in construction and repairs than the close fitting joint and is still in general use with but little modification in design.

Penstocks or water columns have taken the place of tank spouts to a large extent in modern installations of railway water stations, largely because they permit a more convenient location of the tank and also the taking of water at several points. The desirable qualifications in a penstock are a rapid delivery of water with low frictional resistance to the flow of water, and a valve movement that may be handled and controlled easily without water hammer. The construction of the penstock should be such as to permit it to be operated easily and to be economical in maintenance. The importance of the time element in train service requires that the delivery of water to the tender be made as quickly as possible. For this reason the waterways should be of ample size and the flow of water through the column as direct as possible.

The following paragraph on the discharging capacity of penstocks is taken from University of Illinois bulletin No. 21:

"Since the head available in a water column depends upon local and other conditions, and the economic problem is so varied, the selection of a limiting or maximum velocity of flow upon which a general design may be based can not be made. However, it is evident that the economical velocity through a water column and also through the supply main will be much above the limiting velocity used in ordinary waterworks practice where continuous flow throughout 24 hours and the cost

of pumping against the friction head of long lines of mains combine to make the economical velocity less than 5 ft. per second and sometimes as low as 3 ft. per second. Aside from such considerations as the cost of pumping and the giving of sufficient elevation to the supply tanks, the maximum velocity allowable through a water column will depend upon such matters as the satisfactory operation of the valve and the effect of closing the valve in the production of water hammer in the supply main. From a study of these tests and a comparison with water-works practice, it would seem that with a short line of pipe from the supply tank a velocity through the water column of 12 or 15 ft. per second may be considered as the maximum desirable for ordinary conditions, and for longer lines the limiting velocity should be smaller. For a long line of supply main the limit of allowable velocity would be perhaps as low as 8 ft. per second. It would seem, then, that 3,000 gal. per min. for an 8-in. water column, 4,000 gal. per min. for a 10-in. water column and 6,000 gal. per min. for a 12-in. water column may perhaps be considered to be the limit of desirable flow through water columns. It would also appear that a loss of much more than 20 ft. of head for the discharges just mentioned may be considered to be excessive, under conditions of ordinary tank supply."

The principal advantages in the use of penstocks or standpipes are that they permit the selection of a permanent location for a tank remote from the tracks and out of the way of future construction and that they make it possible to deliver the water to locomotives from a single storage tank at as many different points as may be desired. Other advantages are that they do not obstruct the view of signals, etc., they offer better drainage and thereby cause less trouble from soft track and ice in winter, they are less liable to strike trainmen and cars than a spout suspended over the track and they may be protected from freezing more readily than the gooseneck and valves of a tank.

The earlier penstocks were of the rigid-spout type, which permitted a radial movement only, the delivery of water being controlled by a gate or globe valve. The necessity of a flexible connection was soon appreciated and the spout connection was made with a flexible connection to the upper elbow. As with the earlier type of tank spout the manufacturers of penstocks endeavored to maintain a water-tight joint at the upper elbow and at the same time provide a vertical as well as a radial movement of the spout. However, the maintenance of this joint was difficult and expensive, and in 1904 what was known as the Fenner drop spout was put on the market. This consisted of a spout with the upper elbow telescoping into the end of the spout far enough to prevent any water splashing out of the opening. The open joint of this spout not only gives a great range of adjustment, but prevents ice from forming in the joint. This form of spout is provided with practically all modern makes of penstocks and is a decided improvement over the rigid spout as it has a wide range of adjustment in a perpendicular line with the discharge end always in the center of the track and a lateral movement according to the length of the spout. It can be swung out or in, increasing or decreasing the length of the spout to reach the center of the track in the event that the penstock is located between diverging tracks or tracks at different distances from the penstock and avoids the necessity for spotting the engine accurately when taking water. Another advantage in the telescopic spout is that it lessens the liability of the penstock being knocked down, owing to its greater flexibility and in this way reduces the maintenance cost.

It is important that supply lines leading to penstocks be designed properly. A penstock operating under a low head should have a larger pipe than one working under a relatively high head. The same thing is true of a long pipe line. If the maximum delivery is desired the supply line should be at least two inches larger than the penstock. Where several penstocks are installed in a busy yard or where more than one

engine will take water at the same time the supply line should be large enough to supply water to more than one penstock without any material decrease in the delivery. A 12-in. penstock with a 14-in. main 1,000 ft. long will deliver 4,000 gal. per minute with approximately the same loss of head as a 10-in. penstock with 1,000 ft. of 12-in. main delivering 2,750 gal. per minute or an 8-in. penstock with 1,000 feet of 10-in. main delivering 1,750 gal. per minute.

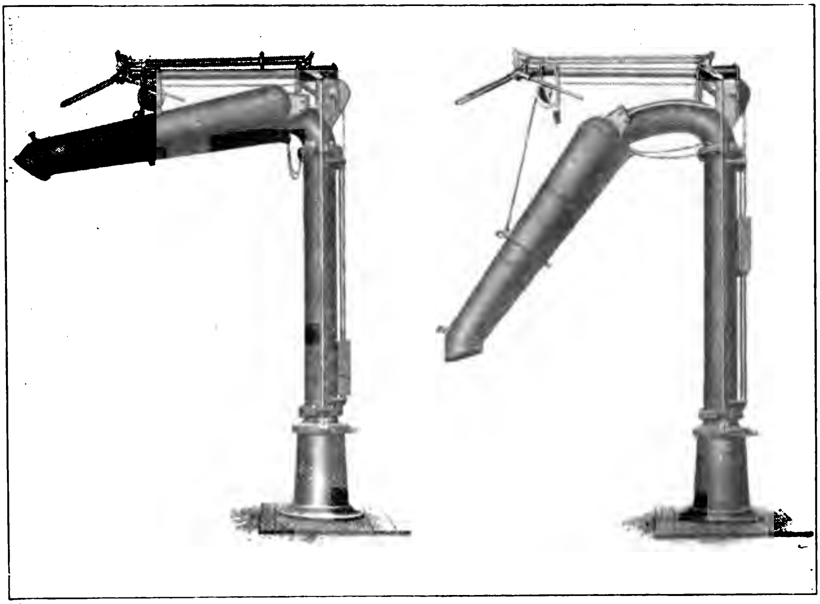
A distance of 20 feet from the top of the rail to the bottom of the tank is generally accepted as the economical height of tower for tanks. A higher tower is not economical on account of the increased cost of elevating the water to the greater elevation, while a lower tower does not furnish sufficient head for the larger engines with high tenders. It is also essential that the tank itself should be within narrow ranges of elevation, to avoid any considerable variation in pressure, as a balanced valve such as used on modern penstocks operates most satisfactorily under a uniform head.

The proper location of penstocks is an important factor in the economical delivery of water. At engine terminals they should be located conveniently so that an engine may take water along with other supplies such as coal, sand, etc., without any switching or back-up movement. Penstocks serving yard engines should be so located that they will not interfere with the movements of road engines handling trains or with the movements of engines to and from the roundhouse. In a large yard it is important that the engines do not block the switching lead when taking water, the proper location of penstocks being at each end of the yard where engines may take water after receiving their trains. In a large yard this may mean a heavy expense for pipe lines, but where there is a frequent train movement the expenditure will be justified by cutting down the terminal delay and facilitating the movement of trains. Where the distance from the main supply tank is very great, as for example at an isolated penstock at the far end of a station or yard layout, it will frequently prove more economical to locate an auxiliary tank opposite the penstock as the supply would be taken by gravity from the main tank through a much smaller pipe than if the engines were supplied direct from the main tank through a penstock main. This is especially true with the present high cost of cast iron pipe. For example the cost of laying a 14-in. main will be nearly double that of an 8-in. main and the difference in cost of 2,000 ft. of pipe will more than pay for a 100,000 gal. wood tank. Where water is pumped by company forces the additional storage will frequently dispense with the services of a night pumper and guard against delays on account of breakdowns.

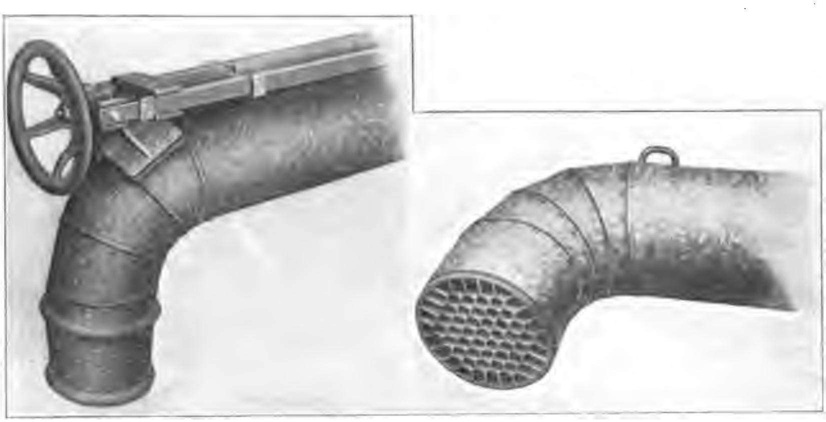
An important feature in the economical delivery of water to locomotives is the prevention of waste while taking water. This is sometimes due to carelessness on the part of the fireman, but more often is the result of faulty fixtures and improper design of the manhole on the engine tank. The great range in the height of manholes above the rail makes it a very difficult matter to provide fixtures that may be adjusted to the varying heights unless the manhole is of liberal size. This is especially true of tank spouts. The manhole should be rectangular in shape and not less than 16 in. wide and 30 in. long. It will be found that when taking water with a spout without lateral adjustment, the spout will be at the outside edge of the manhole on high tenders and near the inside edge on low tenders. Thus it will be seen that it is impossible to avoid a waste of water with round manholes unless they are of uniform height above the rail.

C. R. Knowles,
L. A. Cowsert,
H. A. Horning,
M. D. Miller,
R. C. Henderson,

Committee.



Typical Flexible Spout Water Column



Star Operating Device

Anti-Splash Nozzle

Apparatus for Rigid Spout Water Columns

Typical Rigid Spout Water Column

DISCUSSION

B. F. Pickering:—I ought not to presume to present a minority report, but I am going to do so just the same. In our experience we have not found the telescopic spout economical. The cost of maintenance has been so high that I have replaced it with a rigid spout on six of our 12-in. standpipes. This has not only proved economical, but it has always been very satisfactory in the delivery of water. We have a spout which has what is called an anti-splash nozzle, which consists of a small grating at the outlet of the spout that breaks up the swirling motion of the water so that it descends in one solid column. With that device we have no difficulty in taking water either with a very high or a very low tank. At almost all of our 12-in. and at some of the 10-in. plugs, I have an extension about 20 in. long, hung by a chain from the bottom of the spout. With exceptionally high tanks this is swung out of the way, while the water is being taken, but with the low tanks it is always in position. However, even without the extension I find that we can deliver practically a solid column of water even to the extreme ground or outlet of the drain under the pipe with this type of spout. We found that the telescopic spouts were very expensive in maintenance because of rough handling, which we found it impossible to control. The spouts were continually being broken in one way or another. Frequently it was the back casting of the spout that would be ripped off by the check chains, the fireman pulling them down too hard. The rigid spout is much more simple, with no parts to get out of order, and we have found it far more economical.

G. W. Andrews:—I had not expected to say anything on this subject, because of the fact that Mr. Knowles' paper had covered the ground so thoroughly that I felt it would be useless to say anything, either in defense or favor, but since Mr. Pickering has made his statement of the advisability of abolishing the telescopic spout, I feel called upon to say something. Mr. Pickering has a perfect right to put in his minority report, but he holds that he has no trouble with the rigid spout, other than the width of the manhole. If the engine stops at the right angle the rigid spout will deliver all the water he wants, but if it is 3 or 4 ft. ahead or back, only a small quantity of water

will go into the tank, while an immense amount will go down on the track. I don't think anyone will try to deny the fact that the telescopic spout is more expensive to maintain than the rigid type. Possibly a locomotive is more expensive to maintain than a wagon, or an automobile than a wheelbarrow, but if you want good results, you must expect to pay more for the maintenance. I therefore believe that ninety per cent of the members using telescopic spouts will say that, under all conditions, the rigid spout can not be compared to the telescopic spout. There is one more thing that I want to say in this connection. We have used on our road practically every method that has ever been used in the United States to get water into a locomotive tank, commencing with dipping it out of the stream with a bucket (which goes back a little further than Mr. Knowles' statement that it was pumped by hand). It was dipped out of the stream and poured into a barrel resting on the little truck car which carried the locomotive. We still have one of those which we keep to show what we had to do in the early days. We have used all types of engines from that to the Moguls of the present day, and it has been the trend of our custom to eliminate a rigid spout wherever possible.

C. R. Knowles:—The rigid spout penstock is undoubtedly simpler in design than the flexible or telescopic spout and while the original cost of the telescopic spout is greater than that of a rigid penstock the maintenance of the telescopic spout should be less for the reason that the rigid spout is more liable to damage. For example: If the fireman is careless in bringing the spout around before the engine has been spotted properly it is likely to strike the corner of the cab or car. The flexibility of the telescopic spout will permit it to glance off without damage, which would not be possible with the rigid spout. Our experience has been that the damage resulting from the knocking down of the telescopic spout is only about 20 per cent of that to rigid spouts.

Mr. Pickering probably has local conditions which account for his preference for the rigid spout. I gather from his remarks that his engine tenders are of more uniform height which eliminates the necessity for a wide vertical adjustment of the spout. I cannot understand why his firemen cannot handle the telescopic spout quite as readily as the rigid spout. We have colored firemen through the South who handle these spouts in

taking water, and we find that they have less trouble than with the rigid spout.

As Mr. Pickering says, the anti-splashing device is advantageous in directing the water through the manhole with the rigid spout and we use it quite extensively. The trouble we have found with the anti-splashing device in the Northern latitude, is that ice will form in the upper column above the penstock pit and a thaw will cause this ice to accumulate on the anti-splasher, resulting in the water lifting the penstock column out of the valve chamber. We have a number of the Vanderbilt type of circular tanks in service with which it is very difficult to use the rigid spout. The tender has a height of 13 ft. to the top of manhole, while the grab-irons extend 18 in. above the manhole. This means that it is necessary to maintain a vertical clearance of 14 ft. 6 in. Other tenders have manholes 8 ft. or so above the rail, so you can imagine the difficulty of a fireman attempting to operate a penstock 6 ft. above the manhole.

The telescopic spout has a wide range of operation vertically as well as radially. A barrel may be placed in the center of the track and filled with a telescopic spout having a 14 ft. vertical clearance without any waste of water. While there are some roads that are using the rigid spout exclusively, I think it is very conservative to say that 75 per cent of the penstocks being installed are of the telescopic spout type.

B. F. Pickering:—If I listened correctly when the chairman was reading this report he made the point that the telescopic spout was more economical. Mr. Andrews says, " No one will claim that the telescopic spout is more economical." These two statements don't harmonize.

We have no difficulty in spotting the engine correctly so as to get the outlet of the spout directly over the manhole. On our road it is an inflexible rule that all freight engines shall be cut off from their trains before they take water. It is a very easy matter then to spot the engine correctly. We found in some cases that through passenger trains were not spotted carefully when we had the telescopic spout, and we also found that the ranging of the spout to one side far enough to accommodate the manhole of the tender invariably caused an overflow at the joint, or leakage enough so that the track was flooded, which means a whole lot of expense in the winter time in our cold country, because it keeps somebody picking ice at the stand-

pipe practically all the time. The particular make of spout which we had might have had something to do with that. I have had experience with only one type of telescopic spout, but we certainly consider that type to be far less economical than the rigid spout. We consider the rigid spout better in every way, and we have very much less trouble with overflowing and icing the tracks with it.

And as to the height of the engines, our spouts are set so that the outlet is 14 ft. above the rail. This accommodates the largest Pacific type engines and the large freight engines, as well as the small switchers which sometimes take water at the same plug, but not extensively, because our large yards are nearly all supplied also with smaller plugs which do not have as high a range. With the type of spout which we use we have had no complaint because of their being unable to operate them all right. I think the great range between high or low tanks is maintained as much, perhaps, on our road as any. We have some of the real old types of engines and we have a few modern ones.

R. C. Sattley:—I want to ask if you have any columns broken on account of the rigid pipe?

B. F. Pickering:—No.

R. C. Sattley:—The reason I asked that was that I put in the first two standpipes, I think, that were ever installed on the Northwestern at Sterling, Illinois, and they were of the rigid type. I think we replaced one of those about each week. At that time we did not have a rule requiring the cutting off of freight engines when taking water, and we had much trouble from breakage of those columns. The extension of the pipe would come in contact with the first car. We used to blame the engineers and firemen for not liking the standpipe and we thought that they were trying to do away with them, but we know that isn't so now. We afterwards installed a short section near the bottom which had a crease in it which would break first. Hence when breakage occurred all we had to do was to replace the small broken section and be operating again very quickly.

B. F. Pickering:—I will say that we have had no trouble along that line in recent years. Formerly we had a very much smaller standpipe and we did have a great deal of trouble with it, but it was before the order was promulgated that a freight engine must be cut off from the train in order to take water.

We have had difficulty with ice forming on the anti-splasher nozzle, or rather caking there, after it had formed on the inside of the spout. We have had a 12-in. spout lifted out of the socket by the pressure, but we have taken care of that by installing a relief valve, which I think should be placed on every standpipe. When that is adjusted properly we have had no difficulty whatever with the ice caking on the anti-splasher nozzle and lifting the spout out of the socket.

A. S. Markley:—I agree with what Mr. Pickering has said in regard to the rigid standpipe. We use them on the Chicago & Eastern Illinois and they are doing well. I noticed in particular the complaint that more water is wasted with the rigid than with the telescopic spouts, but I have noted cases where as much water was wasted and as much ice accumulated where the telescopic spout was in use as with the rigid spout. All engines should be separated from their trains when taking water and the standpipes, when not in use, should stand in the direction that trains move on double track. Then if the engine is located anywhere near right and the pipe is swung over the manhole, there will be no trouble about the water not going into the engine tank. We have all rigid standpipes on the Chicago division except two. We keep a duplicate outlet spout at each standpipe and a damaged spout can be replaced in a short time. The rigid spout is the cheapest to keep in repair.

C. R. Knowles:—There is little to be said in regard to the maintenance cost of penstocks. It might be true of any two divisions equipped with the same type of penstock that the cost of maintenance would be much greater on one than on the other. There is no doubt that firemen are being interested to a greater extent than in former years which lessens the damage to penstocks through careless handling. The cost of maintenance will be determined by the care the penstock receives in operation and also the care used in maintenance. The penstock may be carelessly erected, the cables allowed to rust, etc. Any waste from the telescopic spout is due to carelessness or poor design; in some instances the vertical clearance is not sufficient to permit water entering the tender without splashing out the butt end of the spout. Even with a 36 in. manhole, as mentioned by Mr. Markley, it will be found that there will be some waste when the engine is spotted four or five feet out of line on account of difficulty in bringing the rigid spout over the manhole.

In regard to the spout being turned in the direction of traffic,—this is possible only on double track or on passing tracks where the movement of trains is in one direction.

W. E. Alexander:—I think Mr. Knowles' reference to economy was partly in regard to water. If you waste water in any form, it is a loss, and the economy of a standpipe is materially lessened. However, there are other methods of taking water from standpipes that have not been mentioned. We used a different form of standpipe from either of those mentioned. The form we used first had a flexible rubber joint on the standpipe, which allowed the spout to stand up pretty well when it was released, and it would swing over and come down to the manhole. It is a very good pipe, in fact, I think it is next to the telescopic. So far as the rigid standpipe is concerned, we have never used any and so I can not say much concerning them. It always seemed to me that the anti-splasher would be the only thing that would allow them to be used.

We have another joint that was introduced later, a metal joint, packed with a round packing, but it is unsatisfactory in a cold climate. It freezes and this tears the packing, so that invariably the joint will get to leaking. We are trying, as far as possible, to discard that make of joint.

J. Dupree:—If the firemen, after shutting off the water, would wait a few seconds before turning the spout, so much water would not go on the track; but they will not do that. The trouble is that 99 per cent of the firemen are careless. They even neglect to cut the engine off before taking water. They handle the penstocks in a reckless manner. If penstocks were properly handled there would be but few repairs necessary on either type of spouts.

C. R. Knowles:—The reason for having the engine cut off from the train in taking water was not primarily to protect the penstock, but to save drawbars in attempting to spot the engine while coupled to a long train. With the use of the telescopic spout it is immaterial whether the engine is cut loose from the train or not, so far as the penstock is concerned.

P. J. O'Neill:—I have studied the maintenance of standpipes very closely. I have been trying to convince our people how much more economical the telescopic standpipe is than the rigid or the flexible joint. If I had the figures here, I could show where, for a term of eight years, I maintained telescopic joint

standpipes at a cost of 27 cents per month per standpipe for a period of eight years, as against $4.28 per month per standpipe for the rigid type. I found the rubber jointed type to be the most expensive I had to maintain.

I have no trouble with the wasting of water with the flexible standpipe, that is the telescopic spout—while with the rigid standpipe there is always a stream of water or a streak of ice in both directions. The rigid standpipes I have had in use were of the two-man type, where one man down below turned the valve and the other one took the water. However, it was so much easier to swing the pipe around before telling the man down below to shut the valve off, and consequently that is what he did.

I have never had a telescopic spout knocked down by anything other than a wreck, although I have had two knocked down by wrecks. I have had a great many of the rigid spouts knocked down, and also of the type with the rubber sleeve in it. Whenever a train of cars releases and the slack comes down on the engine when it is taking water, at a flexible spout it is good-by standpipe, always. We have orders that engines shall be cut loose from the trains when taking water, but it is ignored more than otherwise. They observe the rule on the main line, but on the branches they don't.

J. B. White:—A great deal might be said in favor of the more modern penstock; in the first place, on a great system we have a difference in the height of engine tanks of from 4 to 5 ft., from the small switchers to the large freight engines whose high coal racks sometimes make it very hard to get the rigid spout around. I have seen firemen take hold of the spout to lift it over the coal and break it off at the break joint. You may say that this is impossible, but when you stop to think of a 12-in. pipe, 12 to 14 ft. high, with no bracing whatever above the platform, and a leverage on the spout of 12 ft. you can readily see how easy it is to break it in frosty weather. Sometimes the fireman has the engineer pull up to allow the spout to pass, expecting to push it around as the engine moves by, but instead the coal rack strikes the end of the spout with a little jar and over it goes. One might say, "Why did he not turn it the other way?" He could not, for the roof of the car next to the engine would not allow it, and to detach the engine from the coaches would cause a delay.

I have heard mention made of anti-splashers and buckets be-

tween the end of the spout and the tank. These are all right for low engines. Nevertheless, on very windy days you will find complaints from the fireman about getting wet when taking water. In some instances in order to be able to take water a high engine will unhook one side of the bucket and leave it that way, and as it is too much trouble for the fireman on a low engine, to hook it up, the company is put to the expense of sending a repair man 100 or 150 miles to hook up the bucket.

On the trunk roads where one has to figure on delivering water to engines which take from 6,000 to 8,000 gal. in 1½ to 2 min. it is absolutely necessary to have everything handy and convenient for the fireman so he can make every move count. Also, with the rigid spout, we have experienced considerable trouble during the winter in keeping the valve rods properly adjusted, on account of frost heaving the penstock platform, thus giving the effect of shortening the rods and not allowing the valve to open properly. We have to adjust the rods accordingly; then, when spring comes, we have to go over them again or the valve will not close. This is very expensive on a large system. You might say that we use concrete for pits, but I have seen a solid 12-in. wall with a concrete top break in two and heave 4 or 5 in. The best remedy we have found for this is to dig a ditch 2 ft. wide and 5 ft. deep around the outside of the pit and fill it with cinders, although where there is a great deal of water this has not always been a success.

C. R. Knowles:—I attempted to prepare comparative figures on the cost to maintain telescopic and rigid spouts but must confess that when the figures are secured one can argue either way as to maintenance. The figures on maintenance, as I have said before are influenced to a very great extent by the care in handling and maintaining the penstock. Some four or five years ago we had the question up of changing the design of our penstocks. Accordingly three different types were installed at one of our terminals. I do not think that we have spent $10 a year on any one of them notwithstanding the fact that they have been in service five years.

R. J. Bruce:—We have tried about all kinds of standpipes there are on the market, and we find the flexible joint, with the rubber connection gives a great deal of trouble. It breaks very easily in the winter. We have also used those with ball and socket joints, but they leak and freeze up and give a great deal

of trouble, so we have adopted the telescopic spout largely because of the benefit to the transportation department. The train crews can take water with less trouble in spotting the engines. While we have orders to cut off the engine to take water, they seldom ever do it.

As far as the upkeep is concerned, I don't think there is very much difference. Our experience is that the telescopic joint is satisfactory in every way.

S. C. Bowers:—We have 60 rigid standpipes on the Pittsburgh division, and we have no order for the engines to cut off from their trains, but the tenders have an opening of about 30 in. If the engines stop within five feet it is all right. We don't have a bit of trouble. We have never had any experience with the telescopic spouts.

ORGANIZATION AND OPERATION OF BRIDGE AND BUILDING MATERIAL YARDS

By H. C. Pearce
General Purchasing Agent, Seaboard Air Line

I deeply appreciate the invitation of your executive committee to address you on one of the subjects which have brought you here for discussion and consideration. In presenting my views on this subject, I have taken the position that you are here for the purpose of discussing and determining the best methods of organizing and delivering the material which you require to do your work.

The question of what department should organize and operate our bridge and building material yards is of much less importance than that they should be properly organized and supervised. There appears to be no good reason why the supply department should not purchase and distribute lumber the same as other materials, and there are many sound reasons why they should.

The location of our bridge and building material yards must be of first consideration, and this must be governed very largely by the geographical location of the property. In the southeast, it has been an open question in the past whether it was either economical or necessary to have large general distributing bridge and building yards. Most of the larger systems in the southeast have a large number of mill operations on their own lines, particularly in Georgia and Florida, and lumber has been cheap. Under these conditions, arrangements can be made with certain mills to take care of certain territories, and by carrying out the budget plan of work and by close supervision and inspection, bridge and building lumber can be moved promptly to the structures where it is to be used and save the cost of operating a general distributing yard and back hauls. This plan, however, leaves many loose ends, and incurs many concealed losses, and is not, and never will be, entirely satisfactory, but the direct saving is so considerable that it must be considered under certain conditions.

On the Pacific Coast, a large portion of the lumber comes by water. This makes it desirable that the material yards be located sufficiently close to the docks and wharves to use switching service. Lumber can be taken from the ships, inspected, segregated and loaded on cars directly from ships' tackle, by placing carriers between sling loads, and can be switched to the yard and unloaded by cranes direct to the piles with practically no more expense than what it ordinarily costs to unload and pile from cars in the yards. In the middle west, the location of lumber yards will depend largely on the location of the timber treating plants and the distributing territory, so that, broadly speaking, the location of the lumber yard must be left entirely to the geographical location of the property, taking into consideration the source of supply and the location of the timber treating plants.

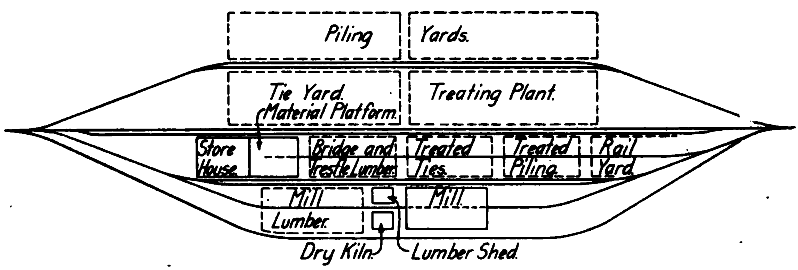
Laying Out of Yards

In laying out bridge and building material yards, the first consideration must be sufficient space and trackage. I have found double tracks to be the most economical. They require less space and ensure a more concentrated organization, switching facilities, and the use

of cranes. Where sufficient water is available, an excellent plan is to boom the piling. Piling can be sorted and classified in this way most conveniently, and taken directly from the water to the carriages or retorts, or loaded directly on the cars. This plan offers many advantages.

Piling, stringers, and other trestle timbers should be unloaded on tracks adjacent to each other so that a train of cars can be set in and as many feet of trestle timber as required, loaded in the quickest possible time. Cranes should, of course, be used wherever obtainable, in handling heavy timbers and piling. I have found steam locomotive cranes to be the most useful for all general service, because they take the place of a yard switching engine, although I can fully appreciate that there are many places where gantry cranes can be used more economically and expeditiously. However for all general purposes a steam locomotive crane will be found most practical.

The ideal bridge and building material yard would include a timber treating plant, a planing and wood-working mill, an assembling yard, a rail yard, a frog and switch shop, and a general store, for the reason that it is desired wherever possible to load everything out complete in one shipment or shipments from a central distributing point. Appreciating that in only very few cases would it be possible to have the ideal location and the facilities referred to in one place, we will take the position that it is necessary that a bridge and building material yard should include the tie and timber treating plant, a well equipped woodworking and planing mill, a material platform and a storehouse. A typical layout is submitted herewith.



Typical Material Yard

The ideal bridge and building material yard should be so arranged that all the material, from the piling to the bolts and washers, will be loaded and shipped in the same train. Frequently a certain number of feet of track, as well as a certain number of feet of trestle, is required. The organization should be such that the necessary rails, fastenings, frogs; switches, etc., can be loaded and shipped along in the same manner.

Organization

Maintenance officers have criticised our supply departments for failure to provide material in an intelligent and prompt manner, and very properly so. The reasons are many, but the principal one is that all supply officers do not understand the importance of assembling their materials so they can be shipped in the order they are needed.

I have heard the statement made frequently, and no doubt it is true, that about the first thing to reach a structure is . . . the roof. This, of course, is absurd, and has greatly discredited the generally excellently organized and efficient work of our supply officers.

The maintenance officer, having prepared his plans and received authority to do certain work, then concentrates his efforts toward getting it done. Under a proper organization, he should immediately prepare his requisitions for the necessary material to do the work, describ-

ing and classifying them properly. By that, I mean, consolidating the foundation material, superstructure, mill-work, hardware, etc. These requisitions, when properly approved, are forwarded, with all the necessary data such as blueprints, and sketches, when necessary, to the storekeeper, who arranges immediately to assemble all the material for this work. For this purpose, he should have sufficient storehouse and platform facilities for assembling such portions of the material required as must be assembled and held together. Foundation material must, of course, be ordered first. This, in most cases, will go direct. Mill-work must be ordered, or manufactured in the mill. Hardware must be assembled, boxed and marked. The lumber requirements must be checked up carefully and any item short provided.

Unless the requisition states specifically that certain portions of the material for the structure is to go forward, nothing should be shipped until everything is ready. The storekeeper will then notify the officer in charge of the work that the material is ready for shipment and will go forward on a certain date,—later advising him the car numbers and date forwarded, and sending him a detail memorandum invoice covering the shipment. All of the material should be charged direct to the job when shipped. When the work is completed, whatever is left over should be picked up, shipped back, and proper credit allowed to the work order.

It may be said that this is an ideal only, but this plan has been in effect on the Southern Pacific Company's Pacific System for ten years, and no doubt it is in use on many other railway systems.

Personnel

The personnel necessary to handle an efficiently organized bridge and building material yard may be said to consist of a foreman in direct charge, with as many working foremen as may be necessary, divided into gangs of about five men each.

It may be said that the foreman should be a practical bridge and building man, and this would appear to be a reasonable conclusion, but the best material yard foremen that I have ever developed were from clerks. I have never been fortunate enough to have developed a first class, all around, capable material yard foreman from a practical bridge man. I appreciate perfectly the need of having practical men who understand the use of material, but these will be found among the inspectors and sub-foremen. What is needed for the operation of a general material yard is a man who is primarily a systematic organizer; a man who is always studying to do things a little better and a little cheaper than before; a man who is not only interested in the material which he is handling but in the systematic working of the organization.

This leads me up to the question as to what department should maintain and operate our bridge and building material yards. I have stated that I know of no sound reason why this work should not be handled by the supply department. My reasons are that the providing, distributing and accounting for materials has become a highly specialized service. It is now generally recognized that the work of buying, providing and distributing materials should not be divided, and that the supply department should have charge of and be responsible for all unapplied materials. Such a department must be properly organized and have a sufficient well trained force to do the work in the most expeditious and economical manner. The handling of bridge and building material offers no more complications than the handling of the other supplies on a railroad, and, in many ways, not as much. The same general organization is required, and the same general procedure must be gone through, both as regards buying, shipping and accounting, as well as the responsibility for supply.

It will be said that the storekeeper or purchasing agent does not know what is wanted,—that he does not buy or provide the right thing. In many cases this is true, but the conclusion is based on the wrong assumption. It is the duty of our technical officers to prepare the specifications and make the inspections. Our maintenance and technical officers should be required to incorporate all of their experience and technical knowledge in the specifications, and the inspectors should be required to follow these specifications.

The supply department is the providing department. It is the duty of supply officers to so systematize their organizations that they will know absolutely before a purchase is made that it is necessary; that the proper materials have been specified; that the requisitions are prepared in such a manner as to procure the broadest competition; to so arrange their materials when received and to so organize their forces that they can be inventoried accurately, loaded, shipped and delivered where they are required in the shortest possible time, and to see that the salvage is returned, sorted, classified, reclaimed and disposed of to the best advantage, or, in other words, it is the duty of the supply department to follow the material from the time it is ordered until the salvage is disposed of. Unless the supply department is organized first on the basis of giving proper and immediate service, it can never be economical or efficient, and can never hope to accomplish the real purpose for which it was organized, which is the providing of suitable materials when and where they are wanted, at the time they are wanted, and at the lowest net cost.

For these reasons, I reiterate that there is no sound reason why our supply departments should not organize and operate our bridge and building material yards in coöperation with our maintenance officers.

I am not unmindful of the fact that this is a very important question to you gentlemen, and that many of you have neither the facilities nor organization at your command to carry out the work as I have outlined, but I am sure you will agree with me that we must have an ideal to work to in every effort, and that our first purpose in every walk of life is to first establish the ideal and then work as near to it as we can. When you gentlemen have a structure to erect, you first prepare plans and specifications. Conditions may arise where it is necessary to change your plans and specifications, but your first plans always form the basis of the future. The same thing applies to the establishing of an organization. You must first understand the fundamental principles governing the condition which you are organizing to meet. You then lay out your organization. The plan must be big enough to meet all conditions. Then it must be curtailed to meet your own peculiar conditions without destroying it. This has been the primary trouble with the supply departments on our railways. They were started on a small basis and added to. They should have been started in a broad way and curtailed when necessity requires, or broadened out to meet changing conditions. So, if you gentlemen will take hold of this situation with a broad prospectus of the ideal plan and coöperate with your supply department in assisting it to obtain the facilities and organization to do the work as it should be done, you will procure the results which you are aiming at and at the same time leave its operation in the hands of men who are trained to do this work and not burden yourselves or your organization with work for which they are not trained or directly interested in.

Supply officers must get away from the idea that their unit of measure is the cost per dollar for material issued. They must get away from the idea that the saving of cents will overcome the loss of dollars. They must get away from the idea that their payroll is the measure of their efficiency. They must get away from the idea that constructive criticism should be resented. They must take on a full understanding of

what their duties are. They must appreciate the men who have big work to do under most adverse conditions. They must understand that the engineer at a washout or wreck wants material then. They must understand that a man who has a certain structure to build within a limited time and with a limited amount of money, must so organize his forces and do his work as not to be delayed. They must realize the need of action, and then act. They must encourage, receive and accept criticism. They must take on the full responsibilities of their position and make themselves a real constructive instead of destructive force. All departments must coördinate and coöperate with the single purpose of the best interests of all, and, in doing this, it will be found that the best coöperation is where each department and each individual does his whole duty, and when this is done it will be found that the very results desired are obtained, and with the greatest satisfaction to all.

DISCUSSION

The President:—It has been my experience that it does not matter very much whether the bridge and building material yards are under the supervision of the supply department or the bridge and building department, provided you have the right measure of coöperation. Once in a while the superior officers have got to pull the conflicting interests together and impress it upon them that both must live. I know that on the Missouri Pacific they had every conceivable organization you could think of, but when I finally got hold of the engineering department I found it didn't take very long, by coöperating with the general superintendents, to get everything we wanted, when we wanted it, and all we wanted of it.

J. P. Wood:—It has been my experience with my stores department—and I believe it is the experience of the average bridge supervisor—that you have trouble in getting your supplies when they are handled strictly by the stores department. We have what perhaps is a good organization on our road in the stores department, and they would like to take our stock over. They did try it but they made a failure of it and we are still handling it. You can place your order with them for building stock (we don't handle our own building stock) just as is outlined in Mr. Pearce's paper, you get the whole plan laid out, get your foundation drawn up and your order placed, and what is the result?—you get the roof materials about the first thing. I have had this happen at a freight house during the past year. One piece would come down in one carload, and another piece in another carload, some of the hardware at one time and some more at another time; they have been using that freight house

for the last six months and some of the hardware isn't there yet. That hardware was all ordered on one requisition.

When a storekeeper will say "I reduced my material account $33,000 last month, and I tell you that looked good to me," it is not absolute coöperation on their part. It did not make any difference to that man how much he delayed you on work; maybe you had to move the men a hundred miles to some other job,—it didn't matter to him as long as he could cut his material account $33,000 in a month and make it look good. He is working for his end of the game.

J. S. Huntoon:—I most heartily concur with Mr. Wood. We have an organization just like that. The purchasing agent gets the material and the general storekeeper sends it out. About the middle of the summer we make our regular inspection. We come in and prepare requisitions. They are marked "wanted April 1st," about nine months later. A year ago when we wanted the material there was no more in the storehouse to do the work with. The bridge gang payroll was running into thousands of dollars a month; we didn't have any materials for three months, and probably the money expended in sending the men around from one job to another was more than the purchasing agent would have had to pay to get the material to us on proper delivery.

B. F. Pickering:—I think that only one side of this question has come to the attention of the responsible officials. The store department repeatedly shows how much it has reduced its stock. That is the great item, and the great excuse, if I may use the word, for the storekeeper's existence, but against that they don't show, and there is no way of showing, and the responsible official never knows, the great cost of the delay caused by the lack of material being delivered to the various working forces out over the road. They only see one side of the ledger, and the storekeeper is very careful to see that the responsible official only sees his side of the facts. He never knows anything about the delays and the great cost occasioned by failure to receive materials. Consequently, he is immensely in favor of the stores department. If an accurate account could be kept of the cost of delays for want of material on the various jobs, one would find that the savings of the stores department would not only be wiped out, but the loss would be seven or eight times all they had saved.

The President:—I got up to say almost exactly what Mr. Pickering has said. It is again a case for the education of the railroad officials, and they need this education to find out what is going on. There is now a well defined method by which they receive statements showing the accounts of the supply department. They ought also to have a report showing in detail the work done on the road and the delays occasioned on the road for want of the material. Then those two taken side by side would enable them to see wherein the supply department was inefficient. It is going to take a long campaign. It is one that can not be fought by the bridge and building men alone. It is a case of gradually pushing against the higher officials.

I have had my hardest fight with the general purchasing agent. He and I were cross-ways most of the time on getting the materials out. I made it a point to keep in touch with the reports in his office of what he had in his material yards, and whenever they were getting down I was right in his office reading the riot act to him to see that material was not delayed.

THE ORGANIZATION AND OPERATION OF A BRIDGE AND BUILDING SUPPLY YARD

By Geo. T. Richards, Superintendent Bridge and Building Shop

C. M. & St. P. Ry., Tomah, Wis.

A bridge and building supply yard is not, as a rule, an institution which has been planned, organized and placed in operation within a brief period of a few weeks or months, but, with few exceptions, it is the result of the gradual development of a comparatively small unit consisting possibly of a small force at a transfer or junction point, a storage yard for a division, or, like the yards and shops of the Chicago, Milwaukee & St. Paul at Tomah, Wisconsin, of a yard for storing and distributing piling and timber. As a result, the additions in the nature of tracks, buildings, etc., are not always located to the best advantage. Additional land is not always available where most desired, and it is necessary at times to locate a building, or to store material, where it is far from being as convenient as it would have been had the plant been planned in its entirety at the outset.

One of the first points to consider in establishing a supply yard complete with wood-working shops, concrete pipe, bridge slab, and pile plants, and other departments which assist in the manufacture of materials used in the bridge and building department, is its location as a receiving and distributing center for the territory to be supplied. It should be situated at a point where piles, timber, lumber, hardware and other building material can be obtained readily and assembled in large quantities, either for storage or for diversion in part or car-load lots to other points for emergencies.

When the C. M. & St. P. located its supply yard at Tomah, Wisconsin, some 30 years ago, the site was evidently selected because of its central location, prior to the construction of the lines west of the Missouri river, and also because it was the terminus of the Wisconsin Valley division which at that time was opening up vast tracts of Norway pine, tamarack and hemlock timber in central Wisconsin. It was also well situated for the reception and storage of the other materials used so extensively in this department.

The plant at Tomah consists of a wood-working shop with a shop foreman in charge of a force of machinists, carpenters, painters, a gang foreman and laborers; a storage yard in charge of a yard foreman, an assistant foreman, crane engineers, mechanics, gang foremen, laborers and teamsters; and a reinforced concrete materials plant with a foreman, an engineer, finishers and laborers. Each of these departments has its special work and duties, and at the same time is so planned that there is the fullest co-operation.

The carpenter or wood-working shop is a large building 65 ft. by 350 ft. divided about equally into two parts known as the front and back shops. The front shop is steam heated and in it are installed various wood-working machines and carpenters' benches. Near the entrance is an enclosure providing an office for the shop foreman where he can readily take care of his records, plans and orders. At the rear and on the side nearest the yard is a space reserved for work-benches, accommodating from 8 to 12 carpenters. The machinery in the front shop consists of moulders, matchers, planers, jointers, a sander, rip, band

and cut-off saws, tenoning, mortising, boring and pipe cutting and threading machines, a turning lathe, a giant dimension planer and saw and knife grinders. The several rip and cut-off saws are so distributed as to call for the least possible carrying of material about the shop. A machine for cutting the gain in ties is now being installed. The method used heretofore was to run the ties through the surfacer, and then to the cut-off saw, after which they were carried to a place where the gaining was done by hand with saw and chisel. Then they were loaded on cars, thereby consuming much time and requiring a lot of handling. With the new machine in service, the ties will be taken from the surfacer to the gaining machine where the gain and cut-off is accomplished in one operation, and then loaded on cars. This machine will save the cost of its installation in a comparatively short time. The machines in the front shop are so arranged that the material is handled through the mill with a minimum amount of labor and time. The first class carpenters and machinists in this portion of the shop are engaged in the manufacture of all kinds of mouldings, interior trim, frames, lunch counters, lockers, station settees, office partitions, forms for various kinds of concrete work, etc. The machines most commonly used are near the front end of the shop with large sliding doors on both sides, thus permitting the lumber to be unloaded from cars at one side of the shop, and reloaded on cars on the other side after passing through the machines.

The back shop occupies the rear half of the building. This is well lighted but is not heated. A standard gauge track runs through its center and connects with other tracks at the far end of the yard. The work of second class carpenters is performed in this part of the shop, assisted at times by first class handy men, and consists of water tanks, towers, sign posts, roundhouse doors, portable buildings, cattle guards and wings, and similar work. Howe truss spans are also framed and erected in this part of the building. On the side of the back shop nearest the yard is a saw mill for resawing timber and piling, which is found very useful in working up surplus and second hand timber.

Adjacent to the shop and located conveniently are a lumber shed for housing finishing lumber, ceiling, flooring, etc.; a shed for storing mouldings, casings and mill finish; a dry kiln; a storeroom for miscellaneous tools, hardware, and small building material; a paint shop; and a creosoting vat for treating ties and guard rail. The shop is under the immediate supervision of the shop foreman, who assigns the work as the orders are passed to him, and who is directly responsible for the finished work.

The storage yard is adjacent to the wood-working shop, and is laid out with a view to minimizing the cost of handling material. It is located on both sides of a main thoroughfare, and near the railway station and the railway yards. Six tracks extend for its entire length, with one track on each side of the shop. A third track is located on the side of the shop adjacent to the lumber shed and the other buildings mentioned above, permitting material to be handled to and from those buildings without interfering with the work in the shop. The three other tracks are on the opposite side of the shop and constitute the yard tracks. They are located at intervals which allow for loading and unloading the material by locomotive cranes, of which two are in use. The material which must necessarily go through the shop is placed where it can be taken to the shop conveniently and to the machines, while other timber used mostly in the rough, and piling are stored in the extreme end of the yard, the piling being kept by itself, and farthest from the shop and other buildings. In storing material it is aimed to pile it in such a way that the oldest or that longest in stock will be used or shipped out first. The storage yard is under the supervision of the yard foreman, who is held responsible for the prompt handling of cars and the loading and unloading of material. In addition to having executive ability, the yard foreman must have a wide experience and a knowledge of the materials, tools and machines which he is called upon to take care of.

The yard force varies from four to six crews of from 8 to 12 men each, according to the amount of work on hand. Two locomotive cranes are in use, and it has been found that they have greatly reduced the cost of handling heavy material through the yard. Experience shows that a gang foreman, a crane engineer and 4 laborers will operate a locomotive crane to good advantage and do as much work in the same length of time as two crews of 12 men each without a crane. The crane is also used for switching purposes, and is especially useful in moving cars back and forth when unloading or loading timber of various dimensions, and piling of various lengths.

A light draying outfit is kept busy hauling material about the plant and small items of hardware and building material to the station for shipment by way freight or baggage. By careful planning, the use of the draying outfit saves much car handling in the yard, and very few cars go out without maximum loads.

A space is reserved for the manufacture of reinforced concrete materials where it will not interfere with other operations of the yard. It is located between two tracks, one of which is used for the unloading of raw materials such as cement, sand, stone and reinforcing bars, and for loading out cement pipe, and the other for storing manufactured material and later for loading it out. Raw materials are so unloaded that they are readily conveyed to the mixers and forms. The chief output of this part of the yard is concrete culvert pipe, but the same force is used to turn out deck and trestle slabs, piles, water troughs, platform curbing, right of way monuments, flue and manhole caps and unit foundations for buildings.

The platform and mixer for the manufacture of all items except pipe occupy the rear end of the space provided; the pipe circle is next, and the storage yard for pipe, which requires considerable space, is in the foreground. An electric hoist within the circle removes and places the steel forms, and removes the pipe from the circle when it is dried sufficiently. A similar hoist at the entrance to the plant loads the pipe for shipment when cured. When the pipe is taken from the circle, it is rolled toward the loading hoist on skids, thus placing the oldest pipe nearest the point of loading. When the storage space for pipe is limited, they may be decked by placing skids over the lower tier. A shelter shed provides a place for assembling cages for pipe and slab reinforcement.

While the plant does not operate throughout the entire year, it runs well into December at times, and may resume work as early as February. In this locality a heating system is necessary for drying pipe during the late fall and early spring months. During the severe winter months the output is so small that the cost of production is too great to warrant its operation. The foreman in charge must exercise great care in the manufacture of concrete products, to see that the sand and stone are clean and of good quality, and that the stone is of proper size. Thorough mixing, filling, and tamping and proper finishing will insure good pipe, and may result in a season's run without a single rejection.

The crew operating this plant consists of a foreman and from 15 to 20 laborers. The records of time, distribution of labor, etc., are handled by the foreman in charge.

The following instructions for handling requisitions, sub-orders and shipping notices are being followed with very satisfactory results:

Requisitions

Requisitions on Tomah yard and shop are made in duplicate. When received, they are stamped with a dating stamp and the originals held in the superintendent's office. If the requisition is for fabricated work to be made in the shop, the carbon copy is sent to the shop foreman and a notation is made to that effect on the original, after which it is placed in the unfilled order file.

If the requisition is for material to be furnished from stock, a sub-

order (as directed below) is issued on the yard foreman and the requisition with proper notations is placed in the unfilled order file.

There is an unfilled order file for each division in which the unfilled orders are arranged numerically and held until the material ordered has been shipped. The unfilled order files are examined daily and studied carefully with a view to seeing that shipments are not being delayed or overlooked and also to plan for the maximum loading of cars.

Orders on the Shop Foreman

The shop foreman, upon receipt of the carbon copy of the requisition, arranges at once for the manufacture of the articles called for and keeps the superintendent advised as to the progress and probable date of shipment in order that shipment with other material may be planned for. When shipment is made, he will note the car number and date on the requisition, sign his name and return it to the superintendent's office where the shipping notice is made.

Sub-Orders on the Yard Foreman

When material is to be furnished from store, a sub-order (Form Engr. 180) is made in duplicate, both copies are handed to the yard foreman and the original requisition with proper notation is placed in the unfilled order file.

The yard foreman places the original sub-order with a gang foreman and retains the duplicate in a special file enabling him at all times to know what orders are unfilled. The gang foreman carries the sub-orders in a metal binding clip of a size that will easily slip into his pocket. Gang foremen are required to deliver their clips containing unfilled orders to the yard foreman before leaving for home each evening.

As soon as the material is loaded the gang foreman fills out the information called for under the heading "shipment made," signs his name and hands the sub-order to the yard foreman.

The yard foreman makes a notation on the duplicate sub-order, places it in his "filled order" file and delivers the original to the superintendent's office where shipping notice is made.

If a sub-order cannot be filled completely in one shipment, it is turned in to the superintendent's office each time a shipment is made in order that shipping notice can be issued.

Shipping Notices

Shipping notices (Form 229) are to be made out in the superintendent's office and mailed on the same date that shipment is made.

The original shipping notice is mailed to the consignee, a carbon copy to the chief engineer, and other carbon copies are sent as requested on the requisition.

Filled Orders

When the requisition has been filled and the shipping notice made out and mailed, the sub-order is pasted to the original requisition and they are pasted in a scrap book as a record for making bills.

Time Returns

Gang foremen keep a record of the time worked by the men under them on a card (Form Engr. 359). On this card is entered the man's number, name and number of hours worked each day. The card is turned in at the office each evening and called for again the next morning by the gang foreman. In the office the time worked by each man is entered in a time book each evening.

The gang foreman also makes a labor distribution for his crew for each day on form Engr. 358 which is also delivered at the office each evening with the time card.

Form 225

Chicago, Milwaukee & St. Paul Railway Company

____________________ ____________________191___

____

I have this day shipped to____________________at____________________

from____________________in____________________, ____________________the following:

ORDER NC	ARTICLES
	SIZE of SHEET $8\frac{1}{2} \times 5\frac{1}{2}$

No.__________

If above material is not received promptly and in good condition, please return notice to Consignor so advising. If MATERIAL IS O. K. DO NOT RETURN.

____

CONSIGNOR

Engr. 188

Chicago, Milwaukee & St. Paul Ry. Co.

ENGINEERING DEPT.

....Supply Yard.

NOTE—The Foreman will enter on this sheet the total number of hours worked by all of the men in his crew on each piece of work. For instance, if 5 men spend 6 hours each loading a car of bridge timber the amount to enter on this sheet is 30 hours.

FOREMAN'S DAILY TIME DISTRIBUTION SHEET

The following is a correct distribution of time for

Crew No.................Date.......................................191.....

....
Foreman.

Req'n	DESCRIPTION OF WORK	Hours	
	Total		

SIZE of SHEET 5½ x 8½

0-8-17 8M

Form Eng. 180

SUB-ORDER

Tomah, Wis.,..*191*.....

PLACED WITH

..............................*Gang Foreman*......................................*191*.....

SIZE of SHEET 8½x4½

Ship to C., M. & St. Paul R'y Co., care of

....

Station..

Division..

Req'n....................*Date*....................*191*.....

for..

....

Ship..*191*.....

SHIPMENT MADE

In....................*Car*....................

....

Way-Bill..

Date..*191*.....

....*Gang Foreman.*

Engr. 359

C. M. & ST. PAUL RY. CO.—ENGINEERING DEPT.

Foreman's Weekly Time Card

....Supply Yard Crew No..........................

	Number of Hours Worked Each Day	Month							191....
No.	NAME	Day							
	Total Hours Worked Each Day								

SIZE of CARD 4½ x 5½

I certify that the time entered on this card is correct.

.... Foreman.

SHIPPING COMPANY MATERIALS ECONOMICALLY

By J. R. Pickering

Superintendent of Car Service; Chicago, Rock Island & Pacific, Chicago

Car conservation is the most prominent factor facing not only the railroads, but the country as a whole today. The railroads are maintaining a large organization at Washington as well as local organizations at all of the principal railroad centers in the country with a view of increasing car efficiency by securing maximum loading, prompt loading and unloading and the expeditious handling of equipment in general.

Much has been said to the public as to their duty in loading cars to the full carrying capacity and loading and unloading cars promptly, until today there is not an industrial concern or individual shipper in the entire United States who has not had this drilled into him thoroughly. In their zeal to impress upon the shipper the importance of car conservation, the railroads individually and through the various railroad organizations have, in a great many instances overlooked their own short-comings, namely, "What will the railroads do to load cars to full carrying capacity and to load and unload them promptly?" I am sorry to say that a great many railroads are deficient in this practice, although there has been a pronounced improvement.

A great many railroad officers and employees feel that in view of the fact that they own or control the equipment they can do as they please with it. This is a mistaken idea. It is the duty of the railroads to practice what they preach. It is just as much of a crime for a railroad to permit the light loading of a car with company material or to permit delay in its loading or unloading as it is for a shipper to detain the car or unload it. The only difference is that the shipper pays for his negligence by reason of demurrage, etc., while the railroads have the mistaken idea that they are not penalized. Such is not the case. They seem to overlook the fact that a car under load or a car unnecessarily delayed in loading or unloading means the waste of car days and an ultimate loss in valuable freight revenue. Too often it is easy to pursue the line of least resistance and load a few hundred pounds of scrap, a pair of wheels, an odd hand car, etc., into a convenient car, simply because the local employe wishes to get the material off his hands. Proper supervision will overcome this. How much easier it would be to establish a regular schedule for shipping scrap to the store department, holding the wheels until a full carload has accumulated (except of course in extreme emergencies), sending the hand car and other miscellaneous supplies to the local freight station where they could be put into a regular merchandise car. These are the practices that must be put into effect if the railroads wish to meet the emergency, do their bit toward conserving supply and secure the coöperation of the public. In ordering supplies, the purchasing departments should order them in full carload lots and buy accordingly, insisting on the industry from which they purchase these supplies loading the cars to the full carrying capacity. This can easily be regulated through the purchasing department and is now being done on a great many railroads. Superintendents, storekeepers, master carpenters, master mechanics, bridge foremen, etc., should anticipate the arrival of material and be prepared to unload cars promptly upon their arrival, adjusting themselves to meet

this condition by arranging with the superintendent to have the yardmaster or agent wire them when the car leaves the terminal point or station billed to them. This can easily be arranged for and is being done on a great many railroads.

The loading of cars can be handled in a like manner. Empty equipment should not be ordered for loading material until the load is actually ready for the car and then all the forces available should be put on the loading until it is completed. This may delay some other work temporarily, but how much better it will be to get this loading out of the way and send the car on its way so that it can be released promptly and put to earning further revenue for the company.

A daily check of the number of cars of company material on hand, the commodity and to whom consigned should be kept by every superintendent. The general office should have a periodical report weekly or monthly showing the number of cars company material handled for each department, the average delay to cars in transit, the average delay to the cars unloading and the average delay to the cars on hand to be unloaded. It is surprising the results that can be obtained by inaugurating a system of this kind and it is the only way to follow up this all-important matter intelligently.

The most important thing to remember however, is that the railroads cannot expect the public to conserve the car supply of the nation and secure their fullest co-operation without first showing the public that they take the lead in matters of this kind.

DISCUSSION

The President:—The paper on shipping company materials is now open for discussion. I hope you members will discuss it actively, because it is a very important subject. The importance to the railroads of loading their cars to capacity is indicated by the report of the movements during 1916, which shows that, notwithstanding the various increases in freight rates which we have heard so much about in the newspapers, the freight was transported in 1916 at a lower cost per ton per mile than anywhere else in the world. Cars which were formerly loaded with 10 or 15 tons now have to be loaded with 35 or 40 tons in order that the companies may get the service out of the cars.

E. T. Howson:—Simply to start the discussion, I want to say that I was in the office of the operating vice president of a large railroad not long ago (he being in charge of operation on a railroad which has been very successful in increasing the average carload of traffic) and he said that when he got to checking up the figures the surprising thing to him was that the improvement had been almost exclusively in the handling of revenue freight. There had been little or no response in the handling of company material. He immediately started a cam-

paign among his own employees. He said that the only explanation he had was that the employees figured it didn't cost them anything to haul their freight, since they were company cars.

L. Jutton:—I think we ought to do a good deal of educational work in our own departments among our own men in connection with the economical handling of cars and loading and unloading them. I believe there are many foremen who don't appreciate the necessity of unloading cars quickly. They think, "Oh, well, I can't get at that to-day, I have got to do some other work." It may be economical for him to do the other work and let that car stand over, but the company does not see it that way; someone outside of the department hears of it and then there is trouble. I think if we will be fair with our own department about releasing cars and about loading them, we will be free from criticism from the other departments, and when we do have a real cause for holding a car, we will be listened to and we will get off a great deal better, and not be criticised as much as we will if we are constantly guilty of holding cars without being able to give a good reason.

The same applies to loading out material from the material yards. If we are careful in the use of our cars and load them to the fullest capacity possible, then we will be able to put up a strong argument in requesting cars, and there will be nobody who can say to us, "Well, you don't deserve a car to-day, because you use them wastefully." I believe that much can be accomplished by educating the men in our own department.

J. P. Wood:—Along this line I may say that our road has put on a new car service man to take care of the cars and to find out why they are not unloaded. He is checking them carefully, day by day, to know why these cars are not being unloaded promptly, and if they are not we hear of it.

Now it has always been my practice to beat the other fellow at his own game if I can, and I have succeeded very well with the car service man. I have placed the responsibility on the foremen that when they receive a notice that a car is coming, they are to be on the lookout for it and not let it get away from them, but to unload it immediately upon arrival. I have also instructed them when they ask to have a car placed for unloading, to take it up with the yard master or the agent, so if there is a come-back they will have something to show. We have been very successful up to date in not having them get

anything on us, simply by being vigilant and constantly on the job. I think the average supervisor will find he has to be constantly on the watch-out for these cars, and if he is, he can do a great deal to relieve the situation, and release these cars for other purposes. And not only that, but, as Mr. Jutton says, it will help him out when he wants to get a car.

J. B. Sheldon:—We have had this matter very forcibly impressed upon our line. Something like a year ago we inaugurated a system on my division whereby each foreman was supplied with a blank form on which he reports every day every car he loads, every car he releases, and every car he has under load and its destination. We make a daily report to the superintendent of the same kind. All foremen have instructions that the loading and releasing of cars takes precedence over all other work.

W. E. Alexander:—A great deal might be said on this subject. The circumstances in each case are different. Now we ask that a car be set at a certain point. We want some material out on the road, perhaps it is five or six thousand feet of plank for some repair work on a branch line. As soon as the car is set we load the material, and there is no other material to put on that car. We need the material at once. The men are in that vicinity and they want it for their work. The material is loaded and sent out. It is unloaded promptly and the car goes on to receive another load. Now, suppose we had held that car and loaded a part of a load on it for one place and a part for another place, detaining that car until the men are out of that vicinity. When the car gets there how are we going to unload it? We will simply have to send men to do it. And if the car is loaded full there is more detention than ever. We send cars out, loaded with small amounts to get it to the men quickly, when they want it. Now I am heartily in coöperation with the handling of material in the best possible method known, but the local conditions govern that. I am impressed with the importance of fully loading the car. But we simply can't do it and keep up the maintenance work and have the cars unloaded promptly. I agree with the idea of conserving the use of the cars, but when a car arrives at a small country station, if the agent is not careful to report it, there is no way for the bridge superintendent to know that the car is there until he finds out himself perhaps, by accident, because traffic is so congested that the car is set any-

where in some out of the way place. Then you get a complaint from the car distributor that that car arrived at a certain place on such and such a day and was not unloaded.

F. E. Weise:—It is necessary to have the full coöperation between the various departments. If a report comes in from the car service superintendent the mistake has already occurred and you can not do anything to prevent it. The effort must come from the men, and the man in the supply yard probably has the worst end of it, because practically all his orders are marked "Rush." He is up against it. Here is an order for material which may not weigh more than 10,000 pounds, going to one division. He has nothing else going that way and probably won't have for a week, and he does not know what to do. In ordering the materials, the man on the work should order it as far in advance as possible, and then there should be some leeway allowed to the man in the supply yard in shipping the materials.

Z. T. Brantner:—I have had quite an experience along these lines. We receive perhaps 200 cars a month for unloading and we load out about 150 cars. In receiving the cars we have a sidetrack on which the cars are placed by the yard master. The time is taken when the car is placed on the track and it is also taken when the car is released. We make an effort to release those cars just as quickly as possible. For instance, if we receive a span of girders, I have arranged special small trucks, on which the girders are jacked up and taken off, taking about four to five hours. I aim to load open cars to full capacity if possible, and if one division does not require all the car will retain, the first division will receive its load on top, and the following division the one underneath, etc. In this way we handle the loading very successfully, and we rarely have cars on hand more than 24 hours.

P. J. O'Neill:—I presume I have as little trouble as any one, for the reason that I have a number of department cars that are used entirely on our work in which I load a lot of small shipments and send them out. The repair gang takes the car along with it. In that way I can send a carload of material out from the yard and when it is all unloaded the car comes back and I load it again and send it out. Every day I have a report from all of my foremen telling what cars they have on the track and what they have released. Every Saturday I compile a re-

port and send to the superintendent for his use at a meeting of the superintendents of the Toledo territory, which is held every month. Since we have been doing that I think we are getting the cars released more quickly. Of course a man will occasionally do something else before he unloads the car, and there are still a good many complaints regarding the detention of cars, but they are being eliminated.

I formerly sent small shipments by local freight, but somehow or other, while the agent would unload everybody else's material, he would perhaps hold that car and notify me that I was detaining it.

The President:—The best method I ever experienced for getting cars out on the line was when I was with Mr. Reid. The repair program was made out on typewritten sheets, and on it was a bill of material for each bridge. The programs were sent not only to the foreman assigned to the line, but to the storekeeper from whom he was to get his material. The storekeeper would keep in touch with the foreman, and when he was advised the storekeeper would load up a full carload of material and send it to the foreman, who would have someone unload it at certain points where they wanted it. Occasionally a whole carload would be shipped to a certain point, if it was on a big job.

R. H. Reid:—When working orders are made out for a certain branch or division, they cover the entire season's work on that division; the bill of material for each job is made out at the same time and sent to the storekeeper, with a copy to the foreman on the job, a copy to the general foreman of the division, and a copy retained for the office accountant, so that each one knows what material is to be used for each job. The material is shipped when we call for it, and it is so loaded that when we start from one end of the division the material wanted first can be unloaded first from the car, and so on. On small jobs we can frequently take one car clear through, doing the work on two or three jobs in one day, then moving along to another station and taking two or three more jobs. If the job is big enough to take several days, we unload all the material for it and then go along with the work. That minimizes car detention and also reduces the cost of handling the material.

Our requisitions are made up with a copy for each interested party, but sometimes material is shipped from the mer-

chant or manufacturer without any notice to anyone. Occasionally the first we hear of it is a message from the car accountant that car so and so has been at such a station perhaps a week, and wanting to know when we are going to unload it. Then of course we get busy immediately and unload it, but the delay there is caused by the failure of the manufacturer to notify our people of the shipment of the material. We are watching the car situation very closely. Everybody from the president down is after us. Of course I keep after the general foremen and they keep after the division foremen. Hardly a week goes by but we send them a circular letter calling attention to the prompt release of cars. We have had very little delay where we have known of the shipment.

A. S. Markley:—How do you distribute the timber?

R. H. Reid:—Ordinarily by local freight. We use very few work trains. I have not ordered a work train this year for distributing material. In former years we did use work trains in some places where we would have a heavy load, and where the regular service was infrequent, but the regular service is better now, and better adapted to our needs, and our people are much more stringent in the matter of furnishing a work train, especially on Sunday. Since the war is on it is almost impossible to get a work train, and unless there is a very good reason for it, we have been told pretty positively not to order one. Work is either done with the regular equipment, or, in some cases, with the help of the road master's work train. Where they have a train they are generally very accommodating and will allow us the use of it.

A. S. Markley:—Then the timber is scattered all along the route, and when the section men come to it they have to pile it up, because if it lies on the ground it will spoil; you would in some cases have those men working all night.

R. H. Reid:—We very seldom find it necessary to keep the men out over night. They go through on the local train, unload the material at or near the jobs, and pile it up in as good shape as they can to protect it, but we do not keep them working on that until they are unable to get back to the boarding cars at night. If we find it necessary to have men out over night, we select those who live at a point near the work who can go home during the evening, so as not to cause extra expense for them.

HOUSING AND FEEDING BRIDGE AND BUILDING MAINTENANCE OF WAY CREWS

By F. E. Weise
Chief Clerk, Engineering Department; Chicago, Milwaukee & St. Paul, Chicago, Ill.

We are told that labor is scarce, that it is hard to secure and that it is still harder to hold. This is reiterated so frequently that we cannot lose sight of it. Under such conditions workmen are inclined to be uneasy and there is a tendency on their part to make frequent changes. Anything that will serve to make men more contented with their jobs will do much to help eliminate the waste that is the sure result of constant changing, because the breaking in of new men is an expensive process, and it is difficult to say just what it amounts to in dollars and cents. Present conditions emphasize the fact that it is not only necessary to pay high wages in order to keep up the working force, but working conditions must be improved and everything possible must be done to keep the workmen in efficient working condition.

The railroads more than any other class of employers are obliged to cope with most varied working conditions and situations, each one with problems that are peculiarly its own. Even on the same railroad conditions vary greatly. The climate may be dry or moist, warm or cold; one line runs through the desert, another through fertile country; one is in the mountains, the other crosses the prairies; and these situations are subjected to the changes of the seasons. It is seen at a glance that the subject of caring for the workmen needs careful study.

One of the hardest places in which to hold men steadily is in railroad maintenance or construction work, and of the many things that have an influence on the conduct of the men there is none more potent than the way in which they are housed and fed. In order to do effective work, and render efficient service, a man must be in good health, and the primary object of the camp should be to keep him physically and mentally fit for his work. Good, wholesome, properly cooked and well served food; comfortable, clean and well ventilated sleeping quarters; provisions made for bathing and recreation will accomplish this and secure the good will of the men. Good will brings about coöperation, and will be reflected in the amount and quality of the work accomplished. The supervisor in charge of the work, the engineering and office force and the foremen should at all times maintain pleasant relations with the men working under them, without encouraging undue familiarity. Discipline must be maintained and it can be done in a manner that will claim respect and win regard. Whether a camp is good, bad or indifferent has so large an effect on the working qualities of the men, that it demands special consideration. Men who are properly fed and housed and who receive considerate treatment will render more effective service, and perform a greater amount of work than men who are dissatisfied and discontented. The general contractor has paid more attention to this question than the railroads and much may be learned from his experience.

While all of the factors making up a camp and its life are important, the one to receive first consideration is the housing of the men, which may be divided into three classes.

(a) The work of some crews extends over so large a territory that it is necessary to house the men in cars in order that they may be transported from station to station as the work requires.

(b) The work of other crews is confined to a more limited territory that can be readily covered by travelling on trains or motor cars and for such forces permanent quarters may be established.

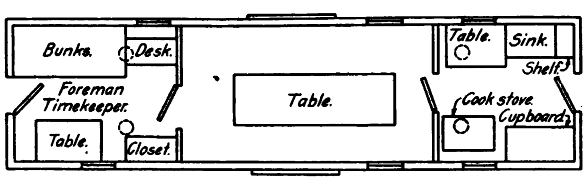
(c) The third class consists of crews organized for some special large jobs, and for whom temporary camps are built.

In all classes the same results are aimed at, namely, to keep the men as nearly 100 per cent efficient as possible and to make them contented in order to minimize the desire for change of location.

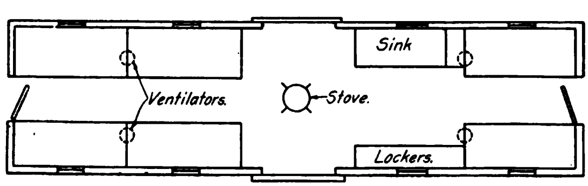
Portable Camps

Let us first consider the housing of men in cars. It has been quite a common practice in the past to house crews in old cars unfit for commercial service and especially was this done for extra gangs in which a complete camp on wheels was established. This practice is gradually becoming obsolete because equipment is too valuable to be tied up in this manner and cars are only being used for crews that must be moved frequently. Where possible it will be found to pay to fit up cars for the purpose of housing men.

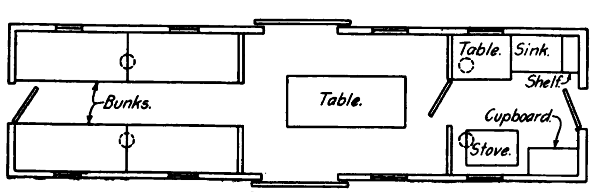
There are many layouts showing arrangements of kitchen, dining room and bunks. It is something like building a house; every man has his own ideas and one plan may be just as convenient as another. Mr. J. W. Powers, supervisor, New York Central Lines, submits plans for a mess car, bunk car and combination car that are good and in another cut are shown three suggested arrangements for combination cars. When it can be arranged for, cars specially designed and built for housing crews will give more satisfactory service. Steel bunks



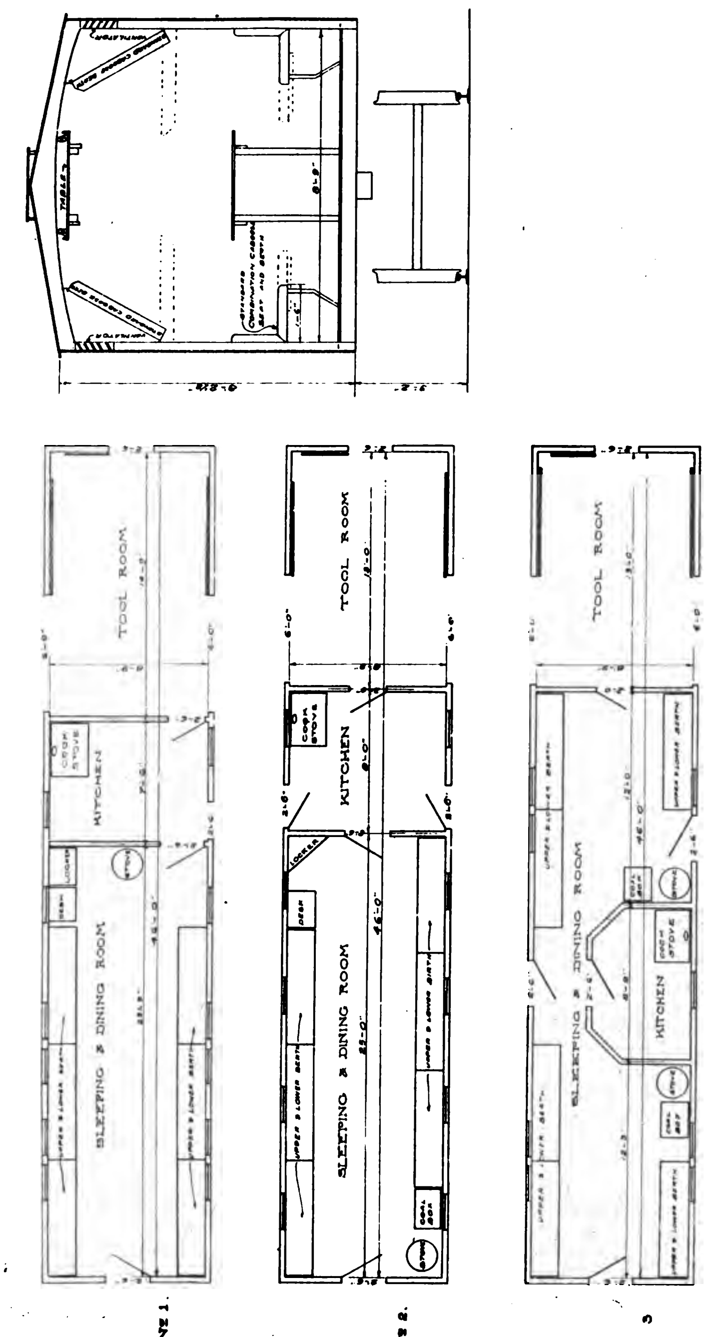
Mess Car.



Bunk Car.

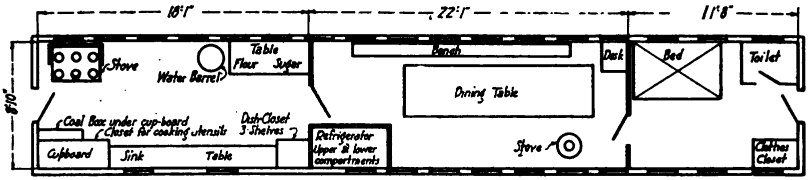


Combination Car.



Tool and Bunk Cars, Chicago, Milwaukee & St. Paul Ry.

should be provided for sanitary reasons and each man should have a separate locker. Cleanliness must be the order of the day and every man in the crew must do his bit in that direction. Toilet facilities should be provided. A number of so-called waterless or chemical closets have been placed on the market and have proven both practical and reasonable in price. A careful study of the different kinds will be found worth while. The problem of feeding the men is similar whether



COOK CAR
BOSTON & MAINE R.R.

the kitchen is in a car, a tent or a permanent building and will be discussed farther on. Every kitchen car should be provided with a refrigerator or ice box and it should be so placed that it is accessible to daily inspection. It should frequently be given a thorough cleaning and drip pans scalded.

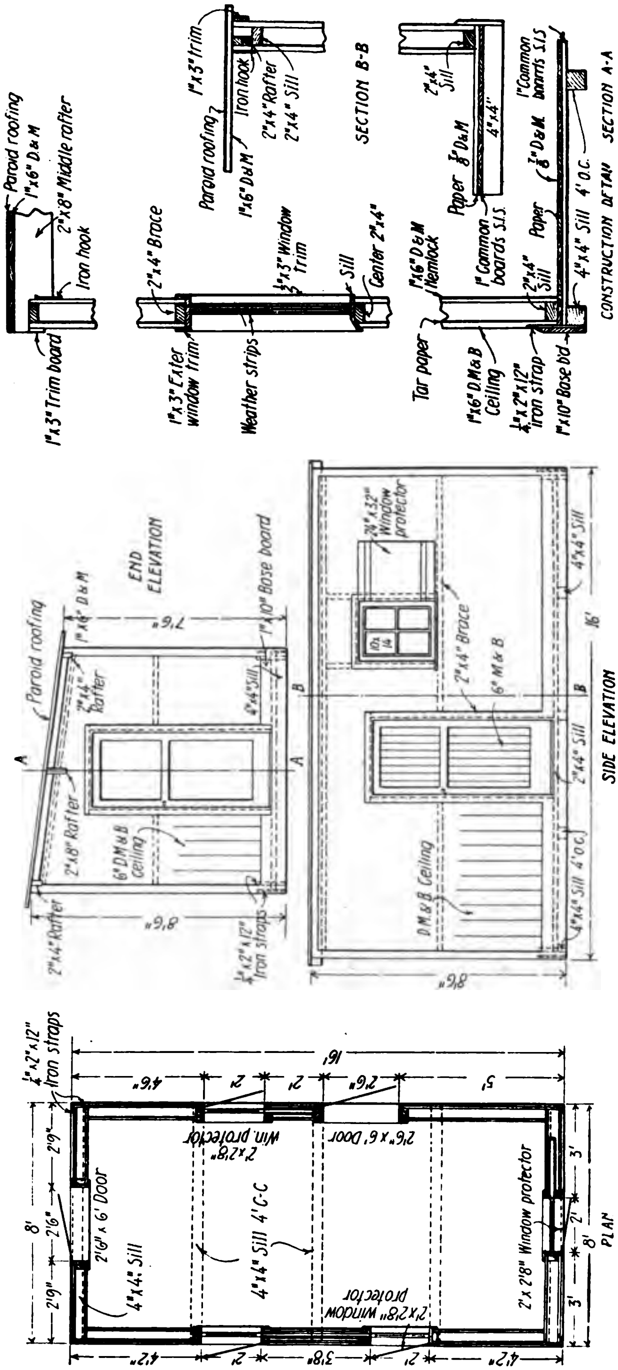
When men can be located at one point and cover their territory by trains or motor cars, it is possible to provide them with permanent and comfortable buildings. Such buildings are mostly of frame construction and may be as varied in size and arrangement as the requirements demand. Some railroads have built them of concrete, others construct a framework, covered with wire mesh and plaster, making practically a concrete building. Again old car bodies are used either singly or in pairs with a roofed space between. The Chicago & Northwestern has a plan for a portable building which can be taken apart readily and shipped to another location if desired, thus making it applicable to either temporary or permanent locations. The building which is illustrated herewith is 8 ft. by 16 ft. over all with a shed roof 7½ ft. high on one side and 8½ ft. on the other. The sides, ends, floor and roof are of separate pieces for convenience in handling, transporting, erecting or taking down. A portable building of this size has many advantages aside from those just given. It can be located any place whether the accessible space is large or small, and it can be disinfected when taken down by treating it with a solution applied with a brush. The buildings can be taken down and loaded on cars at a cost not to exceed $5 each, and can be unloaded and erected at another location for a like amount. (See illustration on P. 141.)

In hot and dry climates it is commonly the practice to use what is known as a Panama roof. A building is first roofed in the regular way using prepared roofing or any form or construction that will be water tight. Studding is then fastened to this roof and a false roof of boards which need not be water tight is then put on, leaving an air space of six or eight inches between the roofs. This form of construction is a very effective protection from the sun's rays.

Temporary Construction Camp

Let us next take up the study of the camp of temporary construction for construction work. When it has been decided that a camp is to be established, the site of the work should be examined carefully, and the location of the camp determined upon by considering the conditions that will make it habitable. Location, water supply, drainage and sanitation should be given careful study.

If located on the railway company's right of way, the space may be limited and the buildings will have to be placed in a row. If so, the



Portable Building, Chicago & Northwestern Ry.

office building should always be between the dining and the sleeping quarters. In some cases sufficient unused land is available so as to allow a more compact arrangement, and in others the physical conditions will, in large measure, control the layout. Camp buildings should be located on high ground whenever practicable so that the natural drainage is away from the buildings and insures rapid drying out after rains. The arrangement of the buildings, and the plan of the buildings themselves will depend somewhat on the location, the material that is available for their construction and the season of the year during which the camp is to be in use. If the camp is to be in operation during the winter as well as the summer, the buildings must be of a more substantial type that will withstand stormy weather and keep out the cold. A camp which is to be used only a few months in the summer time may be of a very temporary form of construction. Most large pieces of work requiring construction camps are apt to extend over a period of a year or more, and while the buildings are styled temporary buildings, they must be substantially built.

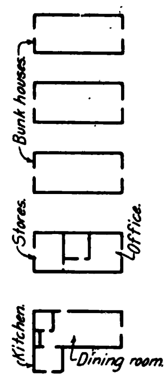


Fig. 1

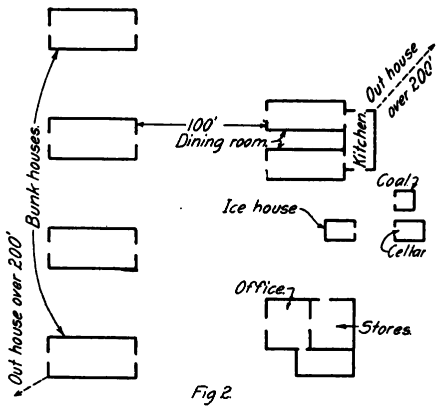


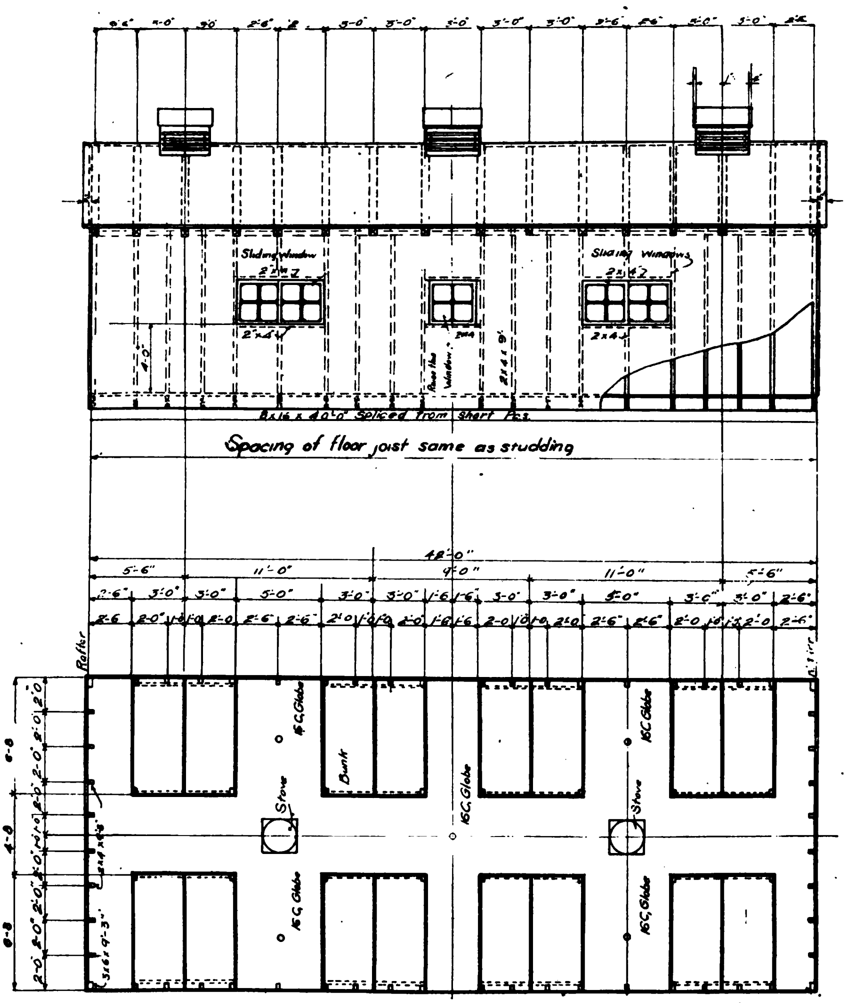
Fig 2.

All camp buildings should be built high enough above the ground to enable a man to clean up underneath. The space under the building is then easily inspected and no old clothes or rubbish should be allowed to accumulate. In the autumn this space should be enclosed as a protection against cold. The buildings should be equipped with stoves or other heating apparatus, not only for the warmth of the occupants, but to dry the rooms out in damp weather.

Office Building

The office building should be of construction similar to the other camp buildings, and large enough to provide for an office for the transaction of business and the performance of the necessary clerical work and drafting, and a storeroom for the camp supplies and the commissary. Sleeping quarters for the engineer and office force should also be provided, either in the same building, or in a lean-to communicating with it.

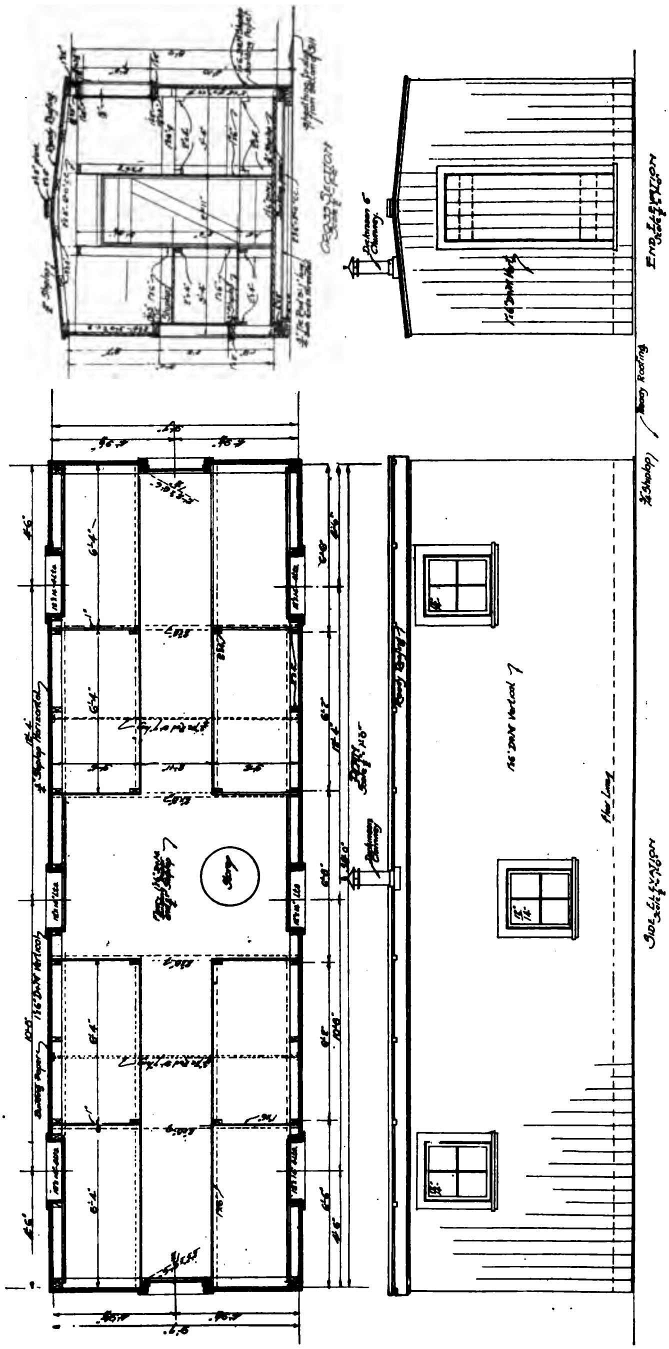
The illustration shows two arrangements that have been used satisfactorily, and also suggests the location of the various camp buildings. In both cases it is to be noted that the office building is so located that the kitchen and dining room are easily supervised and thus promiscuous feeding can be guarded against.



Bunk House, Chicago, Milwaukee & St. Paul Ry.

Dining Room and Kitchen

For the average camp, the dining room and kitchen should be in one building and separated by a partition. In the dining room end sufficient tables should be provided so that the entire force may be served at one time. When the camp is not too large, the building should be long and narrow, the dining room being at one end and the kitchen at the other with entrances at each end and a communicating door between the kitchen and dining room. The dining room should be wide enough to provide for two long tables at the sides with an ample aisle between, which will permit waiters to pass back and forth freely. This form of building can be loaded on a flat car and transported from one location to another. For larger camps it may be better to construct the building in the shape of a " T," in which the dining room is one large room and the kitchen an annex at the center of one side.

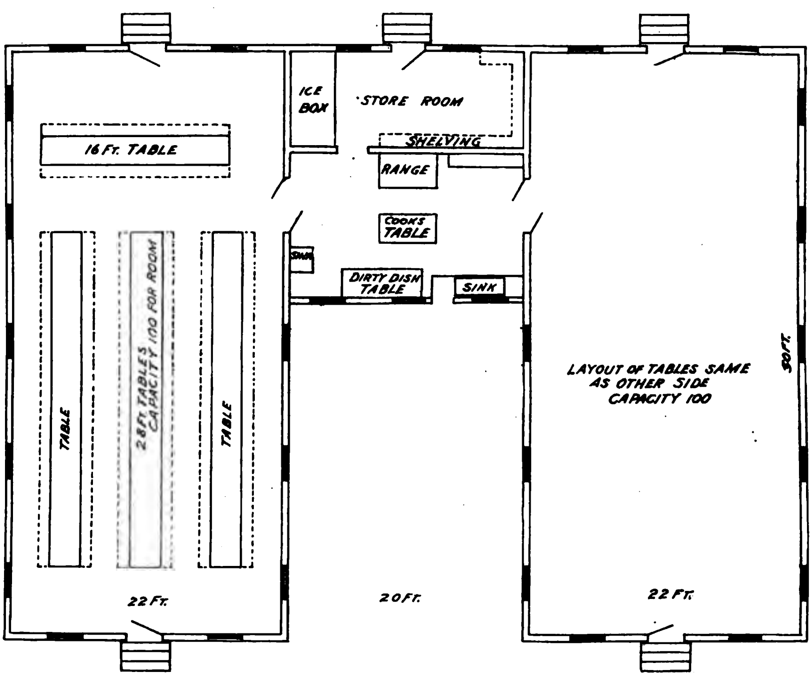


Bunk House, Chicago, Milwaukee & St. Paul Ry.

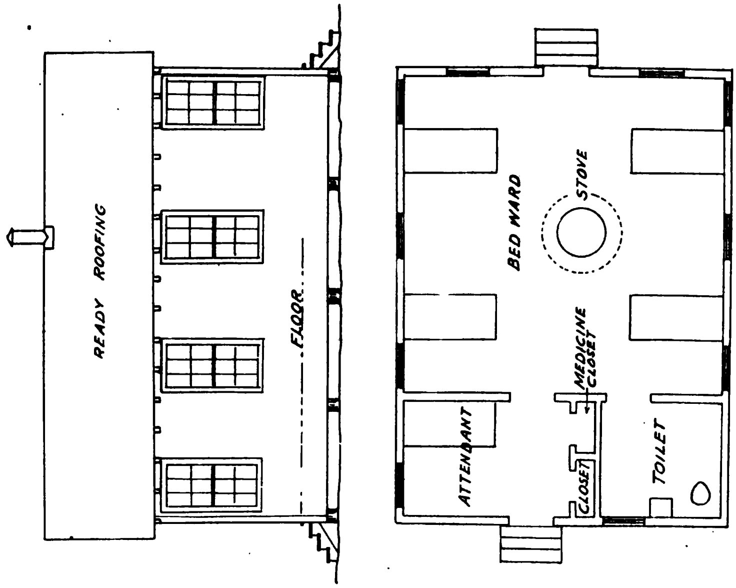
Another good plan consists of three adjoining buildings placed in the form of a letter "U," and provides for two separate dining rooms with a common kitchen. This plan is desirable where the force is apt to fluctuate. When the force is small, one dining room may be closed, and as the work nears completion, one building may be removed without interfering with the camp routine.

Whatever the arrangement decided upon, provide liberally for windows, in order that in cold weather, the dining room will be well lighted and in hot weather the windows can be thrown open. Nothing is more conducive to cleanliness than plenty of light, and it is the common experience that rubbish will accumulate in dark places. Screens for windows and doors are an absolute necessity, and a constant effort must be made to eliminate flies, ants, roaches and other pests. Frequent scrubbing with a liberal use of hot water and soap will be of great help, and a good rule is to scrub the kitchen every day and the dining room twice a week. The dining room and kitchen floors should be swept after every meal.

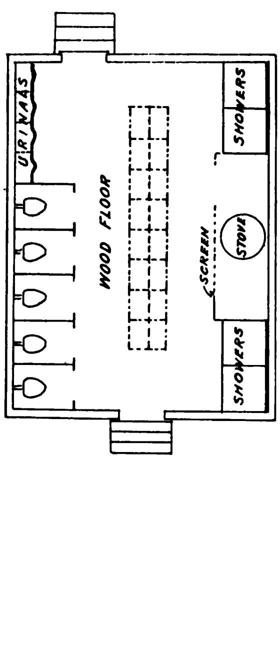
It is usual to provide long tables about 30 in. wide with long benches at each side. Sometimes smaller tables are provided, seating four to six men each, but it is found that this plan requires more waiters and that the men cannot be served as quickly. It will be found more satisfactory to the men to eat at the same table with those they work with and, therefore, each man is assigned to a definite place by the clerk in charge of the camp. The tables should be strongly built and the top at least made of surfaced lumber in order that it may be kept clean.



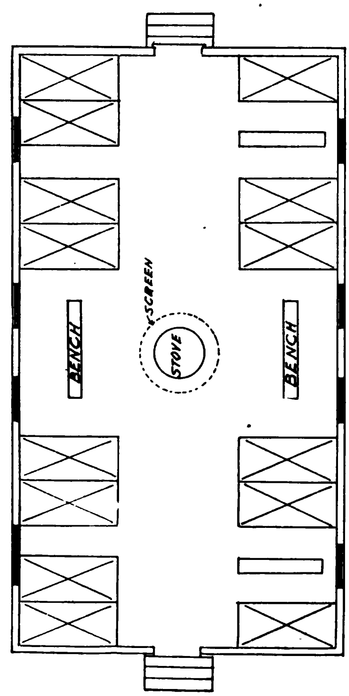
ILLINOIS CENTRAL COMISSARY BUILDING WILDWOOD, ILL.



ILLINOIS CENTRAL ISOLATION BUILDING 22'x30'



TOILET— 18'x24



ILLINOIS CENTRAL BUNK HOUSE 22'x40'

Kitchen Utensils, Dishes, Etc.

Considerable thought should be given to the selection of this part of the outfit. The kitchen utensils should be chosen for their utility. They are in constant use and must be strong and durable. Without being unnecessarily extravagant, select ware that can most easily be kept clean. A little expenditure on quality is a good investment here, because the cook and his helpers will take pride in keeping good equipment in good condition.

The dishes in the dining room should be of a good grade of heavy china or crockery. Tin or enameled dishes have found favor in the past because of their overrated quality of unbreakableness, but this is more than offset by their disadvantages. Tin dishes are hard to keep clean, or at any rate clean looking. Steel knives rubbing on tin or enamel produce a disagreeable and irritating noise, and also are apt to chip off the enamel. They allow the food to get cold too quickly.

Not only can crockery be kept clean more easily, but it adds more to the meal than at first thought seems possible. An office man may find it a little difficult to appreciate this. Should he go on a hunting or fishing trip for a few days, he rather enjoys having his meals served in tin dishes. As a matter of fact, it is the novelty of the change that he enjoys. Unaccustomed activities, together with unlimited fresh air, make him so ravenously hungry that he takes no account of the service. How long would the novelty last? The man in the construction camp is in a different position. Camp life is his daily existence, and there is a natural craving for better things. The same food will be twice as appetizing if served on crockery than if served on tin or enamel, and it makes the man feel that he is considered somebody. Actual experience shows that the breakage of crockery is not large and that its expense is not much greater than other ware. The following list will serve as a guide in preparing for the first requirements of a camp of about 50 men:

Kitchen Utensils

1 Range for Coal 28″x54″	1 Coffee Strainer	6 Water Dippers—1 qt.
2 Griddle Irons 16″x24″	2 Butcher Knives	1 Measure—1 Gal.
6 Galvanized Pails—12 qts..	6 Paring Knives	6 Bread Pans—11″x7″
2 Washboards	1 Cleaver	2 Potato Mashers
2 Stock Pots—10 Gal.	1 Ice Pick	1 Flour Shaker
6 Sauce Pans—6½ qt.	6 Scrub Brushes	1 Grater
4 Dish Pans—30 qt.	12 Dish Towels	1 Egg Whip
4 Frying Pans—12″	12 Waiter's Aprons	1 Cutting Board—18″x24″
1 Skimmer	1 Alarm Clock	1 Meat Chopper
2 Flesh Forks	2 Roasting Pans 22″x22″	12 Tin Cups
2 Funnels	2 Cake Turners	1 Scale with scoop
12 Pie Tins—9″	2 Galvanized Tubs	2 Bread Knives
12 Coffee Pots	1 Stock Pot—5 Gal.	1 Butcher's Steel
1 Flour Scoop	1 Boiler—20″	1 Meat Saw
1 Pot Chain	6 Colanders	1 Ice Tongs
1 Nutmeg Grater	6 Pudding Pans	6 Wash Basins
2 Rolling Pins	4 Soup Ladles	24 Roller Towels
1 Pastry Brush	2 Basting Spoons—18″	2 Mirrors—9″x12″
3 Can Openers		

Dining Room

Crockery

60 Coffee Cups	12 Butter Dishes	36 Vegetable Dishes
60 Dinner Plates	6 Water Pitchers	12 Sugar Bowls
6 Platters—11½″	60 Saucers	6 Milk Pitchers
60 Soup Bowls	6 Platters—13″	60 Sauce Dishes

Glassware

6 Vinegar Cruets	60 Water Tumblers	
6 Salt Shakers	6 Syrup Jugs	6 Pepper Shakers

Cutlery

60 Knives	60 Tablespoons	60 Forks
	60 Teaspoons	

Kitchen

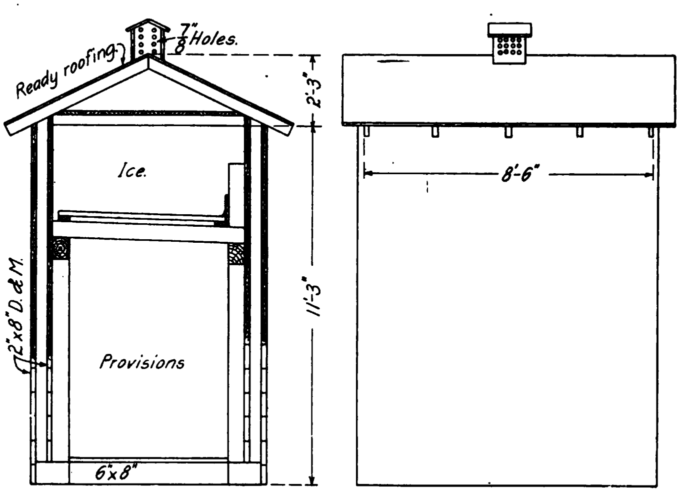
Whether the kitchen is part of the same building or not, it should communicate directly with the dining room, but be separated from it by a partition and a screen door. There should be a door opposite the dining room through which supplies and fuel are received and refuse taken out. It should also be provided with plenty of windows and a ventilator in order that the heat and odors from the range may be kept from the dining room. In the summer time the windows and doors should be screened. The kitchen should be equipped with a range, serving table, sink for washing dishes, cupboard, shelving and a pantry. The pantry is used to store such supplies as are required from day to day, but not in any large quantity. The large stock of supplies should at all times be kept in the storeroom that connects with the office, and the cook will draw therefrom what is needed from day to day.

The cook and his helpers should have sleeping quarters either in the main building or adjoining the dining room, but if in the same building, they should be completely partitioned off from the dining room, and the door be kept closed.

A refrigerator should be provided, and it will be best to have this a separate building located conveniently to the kitchen. This can easily be constructed from matched lumber. The one shown in the illustration is inexpensive and easily built.

For a camp lasting several seasons, a cellar, roofed over and covered with earth, will provide an excellent place for keeping potatoes, beets, turnips and other vegetables.

The force required for a camp of about 150 men will consist of a cook, three flunkies and a commissary clerk. Larger camps will require



additional help in proportion. Much depends upon the cook in the conduct of the camp, not only in providing satisfactory meals, but also in keeping the expenses within proper limits. In small camps and where the cook is found to be thoroughly reliable, it may be found practical to furnish him supplies from day to day without keeping a daily record, but in the larger camps, it is necessary to require him to make requisitions for such supplies as he needs to equip the pantry from day to day. These orders are filled by the commissary clerk, who enters the prices opposite each item, thereby keeping in touch with the daily expense of the camp. The commissary clerk is to keep records of all supplies received from day to day, and of all supplies turned over to the cook each day, and on the morning of the first day of the month he is to make an inventory of all supplies on hand. At the time the inventory is taken, he will make up a statement showing the cost of the supplies used for meals, and all other expenses in connection with the camp, such as oil, fuel, wages, etc. He will keep a record of the number of meals served each day, and at the end of the month will make up a complete statement showing the expense of the camp for the current month, the number of meals served, and the average cost per meal, and also the same information for the entire period since the opening of the camp. Blank forms are submitted which are all very simple and need no further elaboration.

The store room and refrigerator should at all times be stocked with a liberal supply of food, but well kept under control for fear of encouraging extravagance or waste on the part of the cook and his helpers. Arrangements should be made for securing fresh meats at stated intervals and fresh vegetables, butter, eggs and milk can usually be provided for locally. Local purchases must be paid for in cash from day to day and a working fund will be required to take care of them. The cook will perhaps prefer to use canned goods almost entirely because of the ease with which they can be prepared for the table, but it is more economical and better for the men to use fresh vegetables when in season.

The bill of fare will need quite a little study and consideration. While it is planned to give each man a sufficient amount of good, plain and substantial food, properly cooked, at each meal, care should be taken not to serve the same thing every day, but to provide the variety necessary to everyone. Many of the complaints made of the food may be traced directly to a lack of variety and not to the quality of the food or the way in which it was prepared. It will be found that most men crave pies, puddings and pastry, and it will be found necessary to use discretion in the matter. A little extra attention to these matters on Sundays and holidays will go a long way toward keeping up a good feeling in the camp.

It is quite generally the custom to provide free meals for the engineer in charge, the commissary clerk, the cook, the flunkies and the camp help, but the practice should not extend beyond that. All others should either pay for their meals in cash or sign orders for deductions from the payrolls. The boarding of transients should be discouraged, but when this is necessary, they should pay a higher price per meal than the regular force in order that they may share in the supervision expense which is not covered in the prices charged the workmen.

Meals should be served at regular hours and promptly, and it should be the aim at all times to give the best possible service that conditions will permit. Special attention should at all times be given to cleanliness. Waiters must be instructed to put on clean aprons before each meal. After the meal is finished, the dishes are collected and taken to the sink where they are thoroughly washed with hot water and soap. Many of the minor ailments of men in a camp may be traced

CAMP NO.-------LOCATION----------------------------				
Employes Receipt No.-----Date--------------------- Received from Commissary Clerk the following articles the cost of which is to be deducted from my wages at the next pay day				
No.	Description	Rate	Amount	
	--------------------------- Signature.			

directly to the improper washing of dishes. The floors of the dining room and kitchen must be swept after each meal. The tables are to be scrubbed with soap and hot water after each meal, the dining room twice each week and the kitchen floor every day. After the dishes are washed, they are put in place on the tables ready for the next meal, and the whole covered with suitable cloths. Dish cloths and towels are to be thoroughly washed in boiling water after each meal and then dried.

Garbage

Garbage should not be allowed to accumulate. A barrel having a tight fitting cover should be provided, and in this all of the garbage is collected. Once a day this barrel should be taken to a considerable distance from the camp and the contents buried, or better still, burned. A garbage incinerator can be constructed easily and cheaply, and it is by far the more desirable plan.

Water Supply

If a well of good drinking water can be secured, it will be found a wonderful asset to the camp. The well should be located not nearer

MONTHLY INVENTORY OF SUPPLIES DATE-----------------------19--.

CAMP NO.-------LOCATION--

Total number of meals served---------------------------Assistant Engineer.

	Amount on hand last inventory		Received during month		Consumed during month		Amount on hand this date	
	Amount	Cost	Amount	Cost	Amount	Cost	Amount	Cost
Allspice								
Apples (Canned)								
" (Evap.)								
Apricots								
Bacon								
Baking Powder								
" Soda								
Tomatoes								
Turnips								
Vinegar								
Yeast								
TOTALS								

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY COMPANY
Engineering Department

REPORT OF CAMP

At----------------------for month ending-----------------19---

Date camp was opened --------------191---	Previous Report	Current Month	Total to Date
Cost of Kitchen & Dining Room Utensils & Equipment			
Cost of Camp Labor in Kitchen, Dining Room & Bunk Houses			
Provisions and Supplies			
Total			
Number of free meals furnished			
Number of paid meals furnished			
Average cost per paid meal			
Receipts - Cash for meals			
Board Deductions			
Provisions sold			
Total Receipts			

Correct:

------------------------ ------------------------
Commissary Clerk. Assistant Engineer.

than 100 ft. from any camp building, and preferably more, and if possible on a rise of ground. It should be curbed at least one foot above the ground level, and the surrounding space filled in with earth to slope away from the well. It should be properly covered and protected so that nothing may be thrown into it that will pollute the water. It goes without saying that outhouses and the disposal of garbage should be kept at a safe distance, not less than 200 ft. away.

Sometimes a good spring is located in the near vicinity and the water can be piped to the camp. Should the camp be so located that water from a river or lake must be used, the problem becomes more serious, and extraordinary precautions must be taken to keep the water from being polluted. Water taken from a lake or river must usually be boiled before it is used for drinking.

Commissary Store

It is sometimes necessary that a commissary store be run in connection with the camp, especially when the camp is located at some distance from a town. This commissary store is to be in charge of the commissary clerk, and should carry in stock such goods as are most frequently called for and used by the men, such as overalls, shirts, socks, blankets, heavy shoes, overshoes, and standard brands of tobacco. This list may be extended as warranted in the judgment of the engineer, but in no case should it include liquor of any kind.

When a camp and commissary store are run by the railway company, it is not for the purpose of making a profit, but care should be used to see that it is not run at a loss. For that reason careful account-

ing is necessary, and precautions should be taken to prevent petty thievery or grafting.

A commissary should not be run in competition with a local store. In the first place, the conduct of a commissary is an added care that ought to be avoided if possible, and in the second place, it is the desire of the railroad company to encourage business along its lines.

The commissary store should be run on a strictly cash basis.

Accounting

All accounting in connection with the camp and the commissary store should be as simple as possible, but separate books should be kept for each in order that any profit and loss may be allocated to the right source. Two books for each will suffice, one a combined daybook and journal in which all transactions are recorded, and which at the end of the month will show the total debits and credits, and the other a cash book which records the cash transactions only, and should be balanced each night with the amount of cash on hand. In the daybook-journal for the camp, the debit entries consist of kitchen utensils and supplies, fuel, oil, food supplies, and wages of camp employes. This account begins each month with the inventory of supplies on hand. On the credit side will be entered the board of the men, receipts for supplies sold and the inventory of supplies in the store room at the end of the month. The difference between the totals of the debit and credit entries will show whether the camp is being run at a profit or a loss.

Price of Board

It is quite customary, in determining the price to be charged for board and lodging, to charge the employe what he would have to pay ordinarily in nearby towns and then furnish as good board as possible with a view to having the camp pay for itself. The cost of the meals furnished to those employes needed to operate the camp is considered a part of the camp expense. Should there be any employes on the work whose expenses are paid by the Railway Company, the cost of the meals should be charged to the work and the camp given credit. At the beginning of the work the force may be comparatively small, and at the close of the work it will gradually diminish, making two periods during which the camp will not pay for itself. It should, therefore, be planned that when the force is at its maximum, the camp should make some profit in order that, when the work is closed, the accounts will about balance. In order to do this the affairs of the camp will have to be planned and watched carefully.

It will be found more satisfactory to use a rate per week than a rate per meal. In the former case the matter of lost meals need not be watched, and there are apt to be fewer misunderstandings. It will also insure a more regular attendance at the camp meals on Sundays and holidays. If a rate per meal is decided upon, some form of meal ticket will have to be provided, which is punched as the men enter the dining room.

As a general experience a camp of 25 men or less will not pay expenses; a camp of from 50 to 75 men can be made to come out about even, and a larger camp will show a slight profit. This bears out the previous statement.

Bunk Houses

The construction of the bunk house will depend upon the locality and the season during which it is to be used. If in use during the winter, it must be built quite substantially so as to withstand storms and cold. If the bunk house is to be used only for a few months during the summer or in very warm climates, it may be of very light construction, but it should always be so built that it will keep out the rain. It

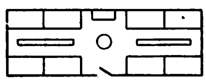


Fig. 1. Bunk House for 16 Men.

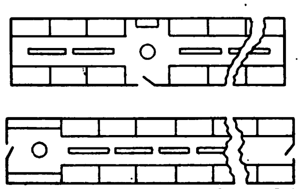


Fig. 2. Two Layouts that Can be Extended

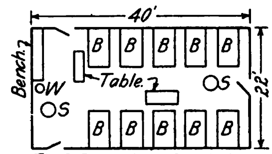


Fig. 3. Bunk House for 40 Men.
W=Water barrel. S=Stoves.
B=Double deck steel bunks, 4 men each.

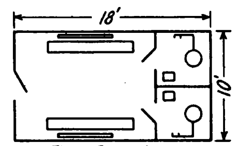


Fig. 4. Bath House.

should be built high enough above the ground to enable a man to get under it, and a positive rule should be made that the space underneath be kept clean and that no accumulation of rubbish or old clothes will be allowed.

Bunk houses or sleeping quarters should not be made too large. It is much better to have a number of smaller houses than to endeavor to make one building large enough to provide for the entire force. There are apt to be disturbing factors during the night, such as someone being taken sick or other unusual occurrences, which will disturb the entire camp if all the men are housed in one building. For the common labor, it has been found desirable to have houses that will accommodate from 30 to 40 men each, although some would limit the number to 24. For the housing of sub-foremen, carpenters and other high grade labor, houses accommodating from 12 to 16 men are preferable.

Bunk houses, built rather long and narrow with bunks on either side and a central aisle, appear to be the most satisfactory and have the added advantage that they can be loaded on cars and transported to other jobs. Old car bodies, when available, may also be used. Sketches submitted show various arrangements. In very large camps it is at times decided to build houses that will accommodate more than 40 men, but because of their size, they are more costly.

It is quite customary to build bunks of wood as shown in the drawing, but great improvements have been made in the last few years in the manufacture of steel bunks, and they are being installed in many camps because of their greater comfort, and the ease with which they are kept clean and sanitary.

There is one item which at first thought may seem an extravagance, but which will do much to hold the men and that is the installation of in-

dividual lockers. Metal lockers may be deemed too expensive but they are more sanitary. They should be in good condition when the camp is taken down and can be used elsewhere. Wooden lockers with doors having an opening of wire mesh can be easily and cheaply constructed. They should be built in two tiers, two feet square and four feet high, large enough to hold a suit case. Good locks with individual keys should be furnished. Each man is given a key attached to a metal tag bearing the same number as the locker. The key is charged up to him and he is obliged to turn it in when he leaves before receiving his pay. Lost keys are charged to the men and deducted from their pay.

In spite of the utmost precaution there is likely to be trouble from vermin. Men are likely to carry them from other camps in their clothing or in other ways. A rule should, therefore, be made that once a month each bunk house is fumigated. After the men have left for work in the morning, the bedding is all taken out, the mattresses turned up, doors, windows and ventilators closed, and sulphur candles burned. Use twice the dose that is recommended by the manufacturer, because bunk houses cannot be sealed as tightly as rooms in a house. After fumigation the bunk house should be thoroughly aired before it is occupied again.

Camp Man

The sleeping quarters are kept clean and in order by a camp man, whose duties are to sweep, carry coal and keep the bunks in order. Bunk houses, except in very warm climates, or when used for only a short period during summer months, should always be provided with stoves. Railway caboose stoves are well adapted to that purpose. In cold weather men must have a place to warm up, and in wet weather there is always clothing to be dried out. Sleeping quarters should not be allowed to become damp and musty.

A water barrel should be provided at each end of each camp building for use in case of fire. In the winter time the water should be heavily salted or saturated with some anti-freezing mixture. It should be the camp man's duty to examine each barrel every day, and see that it is filled and ready for use. A pail with a rounded bottom, marked "to be use only in case of fire," should be provided for each barrel.

Night Watchman

A camp night watchman on duty all night is also a necessity. It should be his duty to see that the lights are put out at the proper time (nine o'clock is a good hour to set), to keep up the fires in winter, and to see that late comers, or those who are inclined to be up late, do not disturb the remainder of the camp. Men will sleep and rest better if they know there is someone on guard to see that they are not disturbed or robbed, and a good night's sleep means better work the next day. The watchman is also there for prompt action in case of sickness, fire or other emergency. It is also his duty to wake the men at the proper time each morning, first the cooks and flunkies, in order that breakfast may be started on time, and then the men, to get them up in time for breakfast and thus start the day right.

Lighting

When it can be had, electricity is the ideal method of lighting a camp, and it can frequently be supplied without undue cost. The camp may be near a town having a power plant, or near some power line

from which current may be obtained. The electric light will do much to insure cleanliness; a temporary installation is not expensive, and it will also materially reduce the fire hazard. On a large piece of work of long duration where power machinery is used, it will pay to install a lighting plant, and especially where the electric current can also be put to other uses.

Where ordinary lamps must be used, they should be kept clean and in good order at all times, and their placing should be so safeguarded that they are not liable to be overturned when being lighted, or knocked over when men are passing back and forth. Bracket lamps fastened to the wall as high as possible and equipped with metal protectors may be used. In many places lanterns will furnish ample light and are safer.

Ventilation

All camp buildings should be provided with sufficient means for ventilation, even though built in the most temporary manner. This refers particularly to the sleeping quarters. Sufficient fresh air without unnecessary exposure to cold and storms will do much to keep the working force in good condition. Should the dining room become too hot and stuffy during meal time the men will complain, and the matter can be easily remedied, but at night men are apt to sleep in poorly ventilated bunk houses without realizing why they do not feel rested and refreshed in the morning. It shou'd be made the particular business of some one man in each bunk house to see that there is sufficient circulation of air before he retires. All windows should be in condition to open and close readily, and the roof should be provided with ventilators. Proper means of ventilation can be installed easily and inexpensively.

Outhouses

Outhouses sufficiently ample for the needs of the camp must be provided, be made as convenient as possible, and located at a safe distance (not less than 200 ft.) from any camp building, where the natural drainage of the ground is away from the camp. The usual procedure is to dig one or more sumps, as may be deemed necessary, and erect suitable outbuildings over them. Such buildings should be kept as dark as possible by painting them some dark color and locating them in a group of trees, because flies shun dark places. They should also be screened. Keep them as clean as possible by sweeping them once a day and scrubbing them twice a week. Provide receptacles for paper. Cleanliness and neatness should not only be encouraged but insisted upon. The excavation for a sump should be quite deep. Once a week the outbuilding should be moved to one side and a layer of chloride of lime and six inches of earth placed over the excrement. When the filling nears the surface of the ground the excavation should be entirely filled and a new sump dug in another location. Chemical or waterless toilets may be necessary in some localities.

It is a common experience that it is comparatively easy to get men to comply with rules for sanitation in camps established for long periods but that they are careless in the small camps established for only a few weeks; therefore strict and definite rules must be laid down and their compliance insisted upon as part of the condition of employment. If the camp is fortunate enough to have a liberal supply of running water so that sanitary closets and a cesspool may be built, these should by all means be provided.

Physicians, First Aid and Medicines

When a very large number of men are engaged on one piece of work, or where hazardous operations, such as pneumatic caisson work, are involved, a resident physician should be employed, whose duty it is to see that the men are cared for, not only in cases of injuries, but also in sickness of any kind. Prompt attention to minor troubles will usually prevent serious illness. He should also be responsible for the sanitary condition of the camp. A building should be furnished for his use as an office and a hospital. If this work will not warrant the employment of a resident physician, arrangements may be made with some local doctor to make periodical visits for general service, and to respond to emergency calls.

When a resident physician is not employed the camp should be provided with medicines and surgical supplies sufficient to render first aid to the sick or injured. Such supplies should not only consist of bandages, antiseptics, restoratives, etc., for use in case of shock or injury, but also of simple remedies to relieve the troubles to which men around a camp are liable, such as colic, cramps, diarrhœa, colds, etc.

It seems almost unnecessary to say that such supplies must be used in an intelligent manner, and yet we not infrequently read of cases where a wrong application has done more harm than good. The man in charge of the camp should be thoroughly familiar with the use of the supplies, and he should see to it that others are also instructed in order that at all times there will be one or more men at the camp who can respond to an emergency. Printed instructions should be posted within the chest or cabinet containing the supplies, and someone should be assigned to the duty of keeping the supplies ready for use and to see that renewals are made before the supply of any article becomes exhausted. It is also suggested that a copy of the American Red Cross First Aid Textbook be supplied with the medicine chest.

It is also suggested that in addition to having printed rules, all the men in the camp be assembled occasionally and given talks on first aid, sanitation, and other things that affect the welfare of the camp. The railway company's chief surgeon should designate what is to be kept and outline instructions for its use.

Following is a list showing the contents of a medicine chest as supplied by the chief surgeon of the Chicago, Milwaukee & St. Paul for use in camps, and also the printed instructions that accompany it:

Contents of a Full Standard Chest

1.	Quinine, 2 gr.	25 envelopes
2.	Cough Tablets,	25 envelopes
3.	Diarrhœa Tablets,	25 envelopes
4.	Headache or Pain Tablets,	25 envelopes
5.	Coryza Tablets,	25 envelopes
6.	Diuretic Tablets,	25 envelopes
7.	Sore Throat (Tonsilitis) Tablets,	25 envelopes
8.	Sodium Salicylate Tablets,	25 envelopes
9.		
10.	Cathartic Tablets,	25 envelopes
11.	Epsom Salts,	50 envelopes
12.	Liniment, Solidified,	24
13.	Porous Plasters,	18
14.	Tincture of Iodine (60 per cent),	2 4-oz. bottles
15.	Gauze.	15 packages
16.	Absorbent Cotton,	6 4-oz. pkgs.
17.	Adhesive Plaster,	6 spools
18.	Bandages, 2 and 3 in. wide,	12 each
19.	Vaseline,	2 jars
20.	Eye Drops,	6 bottles
21.	Toothache Medicine.	1 bottle

Medicine Chest Instructions

All Wounds—The aim to protect rather than to treat. Do not wash wounds nor apply any foreign substance. Apply a few drops of tincture of iodine into the wound and apply a piece of gauze and, if necessary, cotton and bandage. Handle as little as possible.

Small Cuts—Apply a few drops of tincture of iodine and close with a narrow strip of adhesive plaster placed across part of the cut and bandage.

Burns and Scalds—Apply vaseline and a gauze bandage, and send to the doctor.

Crushing Injuries Without Bleeding—Apply tincture of iodine, gauze and cotton to the wound, bandage, and send to the doctor.

Bleeding—Apply tincture of iodine, gauze and cotton, and then bandage snugly. If bleeding is severe and spurting, apply a bandage about the limb nearer the body and tight enough to control the bleeding. Treat wound as directed and get the patient to the doctor within three hours.

Fractures or Broken Bones—Apply cotton and two board splints, wider than limb, one on each side, and bandage snugly. If skin is broken treat with tincture of iodine as directed. Send to doctor as soon as practicable.

Sprains, Bruises or Lameness—Apply solid liniment with plenty of rubbing twice daily.

Colds in Head—Give two cathartic tablets (No. 10) and two or four coryza tablets (No. 5) at bedtime, or one every hour.

Coughs and "Colds on Chest"—Give one cough tablet (No. 2) every two hours, as needed.

Sore Throat—Allow one sore throat tablet (No. 7) to dissolve slowly in mouth every hour.

Constipation and Biliousness—Give one cathartic tablet (No. 10) night and morning and if necessary a dose of salts (No. 11).

Diarrhoea or Cramps—Give one cathartic tablet (No. 10), or Epsom salts (No. 11), and follow with one diarrhœa tablet (No. 3) every hour for a few doses.

Cinders in Eyes—Do not use matches or other harsh material. If unable to remove with a folded piece of bandage, cover the eye with cotton, apply bandage and send to the doctor.

Eye Inflammation—Drop eye drops in the eyes two to four times daily.

Fever—Give two cathartic tablets (No. 10), and follow with one quinine tablet (No. 1) every four hours as needed. If the fever continues, send to the doctor.

Headache—Give one cathartic tablet (No. 10) and one headache tablet (No. 4).

Neuralgia or Pain—Give one pain tablet (No. 4) every three hours if needed.

Rheumatism and Lumbago—Give one sodium salicylate tablet (No. 8) every three hours, if needed.

Chronic Pain in Back—Use solid liniment (No. 12) with plenty of rubbing, or a porous plaster (No. 13).

Scanty Urine—Give one diuretic tablet (No. 6) every three hours and plenty of water to drink.

Toothache—Place a pledget of cotton saturated with toothache medicine in the cavity, or apply to the gums.

Typhoid fever is one of the dangers of camp life that must be guarded against, for if it once gets started the situation is serious. The danger from typhoid may be removed by the hypodermic injection of vaccines. This precaution is being taken by the Government in its military and survey camps. The treatment is very simple and causes the men no discomfort other than possibly a slight grippy feeling that passes off in a day or two.

A record should be kept and reports made of all injuries or cases of sickness even though the application of first aid seems at the time all that is necessary. Later developments are sometimes attributed to these minor injuries, rightly or otherwise, and a definite entry made at the time will do much to determine the justice of a claim.

Steam Plants

It is not uncommon on large pieces of work, especially those involving concrete, to use a steam plant for furnishing power, and when such is the case and it is planned for in advance, the camp may be supplied with hot water at a moderate expense. Refinements (if they may be called such) in outfitting a camp necessarily involve an initial expenditure of material and labor, but many of them pay for themselves in a surprisingly short time, and they accomplish that very desirable feature of keeping the men as nearly 100 per cent efficient as possible, and also satisfied with their jobs. If the job does not require a steam plant, it would still pay to install a heating boiler for the camp alone. A small, elevated tank is easily installed, and this, in connection with the steam plant, will furnish the camp with many desirable features such as

a. Buildings supplied with hot and cold water for washing and cleaning;

b. Buildings supplied with steam heat;

c. Kitchen supplied with a liberal quantity of water for washing dishes and scrubbing;

d. Bath house with showers;

e. Laundry in which men may wash their own clothes.

Bath Room and Laundry

A few years ago a bath room and a laundry equipped with hot and cold running water would have been labeled an unnecessary luxury foi a construction camp, but they have been tried out and proven a paying investment. Nothing is more sure to increase a man's self-respect than to be clean and to know that he is in a position to keep so. A man with a clean body and clean clothes has a personal interest in keeping his surroundings clean and he feels in a fit condition to do a good day's work. Men work with greater energy if they can look forward to a refreshing shower bath at the end of a hard day's work.

A convenient arrangement for a bath house is a building 10 ft by 18 ft. having a door at one end and partitioned off at the other so as to provide two small rooms about 5 ft. by 6 ft. equipped with showers. The two small rooms have a good, substantial floor of wood with a slope sufficient to drain quickly. On the floor should be laid removable wooden racks or gratings on which the men stand. Every day the wooden racks are taken up and thoroughly cleaned and the floor scrubbed by the camp man.

The showers consist of an 18-inch ring of ¾-in. perforated pipe and a 1-in. steam pipe leading to the mixer. Taps or valves for both hot and cold water are within easy reach along the wall, so that each man may easily regulate the temperature of the water. A small bench or stool is also placed in each room. The large room for dressing is supplied with two radiators and two long benches. The building has a gable roof with a ventilator.

A device in use in the British army may afford a suggestion in cases where the water supply is scanty and the drainage conditions are poor. It is known as a "Russian Bath" and consists of a well constructed tarpaulin hut into which steam is led and distributed by a perforated pipe running along the floor. A 15-lb. head raises the temperature to 100 deg. in a few minutes. The bathers undress and enter the hut, the moist heat causes profuse perspiration and the application of soap raises a good lather on their bodies. They then enter an adjoining room roofed by a grating onto which a bucket of cold water is thrown, which causes a spray that quickly removes all traces of the lather. This device is quite efficient and it is readily seen that very little water is used and the drainage problem is easily solved.

Laundry

A building to be used as a laundry in which men may wash their clothes, will also be a good investment. It should be a separate building similar to a tool or cement house, and supplied with hot and cold water, a half dozen tubs and a radiator in order that clothes may be dried indoors in winter.

Smoking

It is not necessary to make rules in regard to smoking, except that men should not smoke in their bunks because of the danger from fire, and that there should be no smoking in the bunk house after the lights are put out at 9:00 P. M.

Intoxicants and Gambling

Intoxicating liquors should not be permitted around a camp in any form, and habitual drunkards should not be allowed on the work. Gambling should be strictly prohibited.

Recreation

Even though men are engaged in manual labor, they find rest in active sports such as boxing, wrestling, quoits, base ball, etc., and some provision for such can be made at little expense. For rainy days indoor games, such as checkers, dominoes, etc., will help pass the time agreeably, and books and papers are welcome at all times. At some camps musical instruments have either been provided or are owned by some of the men and do much to keep them entertained.

Military Camps

Much may be learned by noting what the U. S. Government is doing at its various cantonments and training camps in providing for the physical welfare of the soldiers. Modern army hygiene has been brought to an exact science which has had its most rapid development and perfection during the last twenty years. Should a soldier fall sick he is given the promptest and best of medical attention, and not only that, every possible precaution is taken to prevent the chance of development of disease or the spread of infection.

The following appeared recently in one of our daily newspapers and shows how thoroughly the subject of camp sanitation is outlined and carried out:

"Each large army area has not merely its regimental doctors and hospital surgeons and physicians, but a visiting sanitary inspector, with a staff of sanitary service men in each camp, who devote their entire time to inspecting and keeping up to the mark all the sanitary arrangements of the camps."

"In most camps every particle of refuse, of night soil, of garbage that cannot be utilized, is not only collected every morning with the most scrupulous care and cleanliness, but completely destroyed by burning, which ends at once all possibility of its ever getting into the water supply or fouling new camp sites or reappearing in any possible way to cause trouble in the future. All the manure from the horse lines, cavalry, artillery or transport, is either spread upon the land at once, often by the thrifty farmers of the neighborhood, or burned. This burning process calls for a good deal of trouble and skill, but it has another tremendous advantage in camp hygiene—that it robs our most intimate enemy and pest, the fly, of most of his hope of existence by depriving him of both pasturage and breeding grounds. This is supplemented by a vigorous anti-fly campaign, with the result that a large proportion of our camps on the western front are comparatively free from the plague of flies. This means that two-thirds of the risks of diarrhea and dysentery are wiped out at one stroke and accounts for a really astonishing scarcity of both these typical camp diseases."

It was the army doctors who discovered that typhoid was not alone the result of impure water, but that flies carry typhoid infection, that it may be contracted from eating contaminated food and that it may be spread by unwashed and unclean hands. The best safeguard against this is typhoid inoculation. Unclean hands are also liable to cause other troubles such as dysentery, cholera and other intestinal diseases. It is known that malaria is spread by one kind of mosquito and yellow fever by another. Swamps are being drained, ditches opened up, pools oiled and fish planted in waters where mosquitoes are apt to breed, and by these methods they are finally routed out.

Water cannot be used for drinking purposes until it has been ana-

lyzed and found safe by the medical officer. Dipping drinking water from pails or other containers is forbidden and all containers must be tightly covered as a protection against dust and other infection. When it is found necessary to use water that is contaminated or doubtful it must first be sterilized, which is done with hypochloride of calcium.

Kitchens and mess-halls are carefully screened and ceaseless warfare is waged against the fly. Dishes and tableware must be protected from flies and dust. Dishes and cooking utensils must be cleaned with hot water and clean towels. Ice-boxes must be frequently inspected and cleaned. All food supplies are carefully inspected by sanitary officers and the irresponsible vendor of foods is not permitted in the camp. The following foods are forbidden altogether—canned milk and canned fish opened the day before, hashes of meats and potatoes prepared the day before, and green vegetables in localities where they are likely to be contaminated.

The following personal requirements are insisted upon—bath at least twice a week; hands washed before each meal; teeth brushed once a day; underwear changed frequently; bedding and clothing sunned and tents aired daily; tents struck frequently to sun the sites.

General

It will be seen from the above that there are many factors entering into the management and operation of a camp. The physical features are in a large measure controlled and modified by the nature of the work and the camp, how long the job will last, the natural resources of the surrounding country as to food supply, the proximity of town or city, and many others. It will pay in all cases to provide the men with the best, within reason, that the circumstances will permit, without being extravagant or wasteful. Much will depend upon the attitude of the supervising force toward the workmen. Treat all of the men, whether skilled mechanics or common laborers, as men, let them know that you appreciate their labors, win their respect and regard, get them interested in the progress and success of the work, and you will have done a great deal toward holding your forces together.

APPENDIX A

PUBLIC HEALTH REGULATIONS

The state commissioner of health of the State of Washington has prepared a set of rules and regulations governing sanitary conditions in industrial camps in that State. While similar regulations have been adopted in other States, the Washington rules are printed below because of the general interest in this subject at the present time:

Washington Rules and Regulations

1. Hereafter contractors and all other persons who may establish an industrial camp or camps for the purpose of logging or any like industry or for the purpose of constructing any road, railroad or irrigation canal, or other work requiring the maintenance of camps for men engaged in such work, or any other temporary or permanent industrial camps of whatsoever nature, shall report to the state commissioner of health so as to maintain good sanitary conditions, and shall at all times keep such camp or camps in a sanitary condition satisfactory to the state commissioner of health.

2. The health officer of each county shall report to the state commissioner of health on the location and sanitary condition of all industrial or construction camps within his jurisdiction in the month of June each year, and at such other times as the commissioner of health may require.

3. All contractors and other persons responsible for the control and management and construction of industrial camps must use all reasonable precautions to protect the men in their employ from disease, and to that end they shall comply with the following regulations adopted by the state board of health,

4. The following are the instructions and recommendations relative to the proper sanitation of camps. The natural topography of the land where camps must of necessity be located renders it impossible to specify in detail complete plans for temporary camps, but the management of camps will be held strictly responsible for failure or refusal to comply with the general intent and spirit of these regulations.

(a) Camps must be established upon dry, well-drained ground.
(b) All natural sink holes or collections or pools of water must be drained and filled when the camp is first established.
(c) The stable and kitchen must be separated by a distance as great as consistent with the natural topography of the land upon which the camp is located.
(d) The toilets must be located convenient to the bunk houses, and as far removed from the kitchen and eating house as may be practicable.
(e) The use of toilets provided for the men must be made obligatory, and instant discharge of any employee polluting the soil in the camp must be rigidly enforced.
(f) In camps of 100 or over there must be one employee whose principal duty shall be to act as scavenger and garbage collector.
(g) All manure from the barns must be collected and burned at least once in each week. Instead of burning, the manure may be used as fertilizer on fields not less than one-half mile from camp.
(h) All toilets in the camp must be fly-proof. (The state board of health will furnish drawings of inexpensive fly-proof toilets upon request.)
(i) The kitchen and eating house must be effectively screened against flies.
(j) Garbage must be collected in tight cans and burned or buried daily. Garbage may be fed to pigs provided the pen is located not less than 100 ft. from the cook or eating house and kept in a sanitary condition.
(k) Tin cans and other non-inflammable refuse must be collected daily and burned over every ten days or buried in a pit.
(l) Food supplies must be carefully screened and thorough and systematic scrubbing of kitchen, eating houses and bunk houses must be observed.
(m) The supply of water for the camp must come from an absolutely uncontaminated source.
(n) Care must be taken not to pollute the water supply of another camp or the water supply of any of the people of the State of Washington.
(o) All sick from whatever cause should be isolated from the remainder of the crew immediately.
(p) All persons engaged in the care of the premises and handling of the food, particularly cooks and helpers, should be carefully examined and particular attention paid to the point as to whether or not they have suffered from typhoid fever within recent years.

APPENDIX B

ALASKAN RAILWAY REGULATIONS

Construction camps shall be located on the best site obtainable, from the standpoint of water supply, drainage and sewage disposal, consistent with convenience to work.

Water Supply

When the water supply is to be taken from a stream the point of intake shall be above the camp site, and a sanitary survey of such stream above such intake shall be made to ascertain if there be any source of pollution. If there be a source of pollution of such stream such fact, with all available data, must be reported at once to the sanitary officer of the division, by the district engineer, and a well dug to conform to the following regulations:

No well may be located less than 100 ft. from any cesspool, toilet or stable, and must not be on ground receiving drainage from any such place.

All wells supplied with pumps must be curbed up to a point one foot above the surface of the ground and tightly covered.

All wells supplied with ropes and buckets must be curbed up to a point 30 in. above the surface of the ground, and fitted with a good cover.

All wells must be backfilled with earth or gravel around the curb to a depth of one foot at the curb, sloping to the surface of the ground six feet away from such curb, in order that surface water cannot get into the well.

Cook Tent

The cook tent must be located on sloping ground or that which can be drained easily. The floor of such a cook tent shall be of dressed lumber, preferably tongue and grooved flooring, water-tight; if not water-tight, such floor shall be raised 12 in. above the surface of the ground so as to permit free circulation of air underneath; must be scrubbed daily and kept in a clean and sanitary condition at all times.

All fixtures and utensils must be so arranged as to permit of free access for cleaning purposes.

All work tables and other utensils must be kept free from accumulations, such as flour, dough, grease, etc.

All canned goods, excepting milk, must be emptied as soon as opened, and not permitted to stand in original tin cans.

All garbage should be burned in the cook stove as completely as possible.

Suitable fly-proof and water-tight cans must be provided into which all scraps, empty cans, and waste material shall be placed, which cans shall be removed to a point remote from camp, and the contents either buried or burned.

Such removal should be made every second day from May to September inclusive, and once a week during other months. Throwing such garbage in streams will not be permitted.

A well ventilated, properly screened fly-proof meat house shall be provided adjacent to the cook tent, for storing small quantities of fresh meat. On receipt of any fresh meat in bad condition, from any cause whatever, such fact, with full data, must be reported at once to the district engineer, who will report same to the sanitary officer at Anchorage.

Mess or Dining Tent

The mess or dining tent shall be separated from the cook tent or kitchen by a door or fly that may be closed.

Tables shall be provided with cotton fly-screen, which shall be kept spread over the tables except when they are being used to serve meals. Mess tents shall be kept as free from flies as is possible, and suitable measures must be taken to secure such results.

DISCUSSION

F. E. Weise:—The matter that has been collected here shows what should be provided in what might be called an ideal camp. We cannot always reach an ideal camp, but wherever it is possible to provide the things that are spoken of they will be found of advantage, because they will keep the men in a good, efficient condition.

A. Montzheimer:—I think the two papers that have been presented this morning are always important, but to my mind they are more important now than ever before, on account of the great scarcity of labor. I don't think one point has been emphasized sufficiently and that is the condition of the cars in which the men are housed. Most railways provide the men with old coaches and in some cases, with old box cars which are unsafe to handle in heavy tonnage trains, and there is a liability there that may prove serious. On our road we have built steel underframe cars in the last few years, especially for the men. These cars are the ones the men are in when they are in the train on the road. The other cars hauling their tools are still of the old type.

R. C. Sattley:—I have just one suggestion on this last paper—that a first-aid outfit be supplied with every camp. On the cars used by the Government in the inspection of the railroads of the country for valuation purposes those kits are provided. In addition, I think there should be a Red Cross book in every camp.

The President:—I think one of the most important suggestions that has come up in this paper, and which has been conspicuous by its absence in most of the boarding outfits, is that regarding bathing facilities. It reminds me of a story of a little boy whose mother sewed him up in his underclothes and sent him to school. He had been going in a steam-heated schoolroom for

about a month. Finally the teacher didn't like his smell, so she sent him home with a note which said, " Give Jackie a bath and send him back." Jackie came back all right, and written across the bottom of the note the teacher had sent was scrawled, " Jackie isn't a rose—learn him—don't smell him." I think it is very important that there should be facilities in the boarding cars for the men to bathe during the winter, rather than to stay in their clothes until they don't resemble a rose.

J. E. Toohey:—The matter of keeping the bedding and the clothes of the men clean in the camp outfit is a serious matter with us. A year or so ago I devised a plan to wash them in a concrete mixer. We have a small gasoline-operated concrete mixer that is easily started. We heat the water with a steam pipe from a derrick car and the men wash the blankets once a month without any coaxing at all.

A. S. Markley:—Bridge and building men are away from their families more than any other class of men on a railroad. We cannot bring their work to them; they must go where it is. Consequently they are away from home nearly all the time, and we should make conditions as favorable and as comfortable for them as possible. We are gradually getting better outfits to house our men than formerly. In our camps they cook and eat in one car and sleep in a separate car, while we provide one combination car for the men to pass the evenings in, and one car to house the tools. The men are allowed to go home once a week, but they should have Saturday afternoon off to go home. If they go home Saturday night and return Monday morning they are not very energetic on Monday, after riding two nights. The office men get off in the summertime at 1 o'clock on Saturdays. Why not the bridge men?

It has been said that the gangs can board locally or at home. Some of our gangs have men from five or six different towns. We have to get them wherever we can. A man who don't want to go home to spend Sunday with his family is not the man we want to employ for best service.

In our bridge and carpenter gangs, where the men are employed steadily, they furnish their own bedding, stove and cooking utensils. They are furnished a cook who does the buying and cooking, takes care of the cars and does the clerical work.

Where we have a gang using common labor, such as a concrete gang, the foreman adds a couple cents on each meal to pay

for bedding, cooking utensils, etc. The fence men have the same privileges as the bridge men. The company furnishes the cook, and their meals cost them from 18 to 22 cents each. The cook, as a rule, has charge of the commissary and at the end of the week each man's meals are pooled and the cost is then divided among the camp so that all the men fare alike on the cost of living.

J. P. Wood:—I don't believe that it is a good policy to have any set time that a man should stay on the work. I don't practice it on my division, but I allow the men to go home once in two weeks, once in three weeks, or every night, as conditions permit. At the present time my entire force is working practically 7 days in the week, owing to the material situation. Our material has been delayed and we are now trying to catch up, but nevertheless, whether we get the work done this year or not, the men are going home after they have been on the work a reasonable time. When we are working under normal conditions I tell my foremen to let the men go, especially the married men, at intervals of not longer than two weeks, and just as often as possible. I realize the situation that these men are in perhaps better than the men themselves, because I have been there. I know what it is to stay away from home anywhere from one day to eight weeks. I love my home and so does the average man. If he doesn't love his home tell the foreman to fire him. You don't want him. You are better off without him, because eventually he will be a disturber among the men. He will cause discontent. We have it, but we try, when we find those fellows out, to let them go quietly. We get rid of them.

W. F. Strouse:—The question has been raised as to the general practice among the various railroads in regard to the expense of the board, and as to whether overtime is allowed on account of the men having to pay their own board. I would be glad to hear some expression on that subject.

H. Bender:—I don't see why the men should be allowed overtime because they have to pay their own board. They would have to pay it elsewhere. It seems to me that if they were allowed their regular time, and overtime if they worked, it would be sufficient.

S. C. Tanner:—On the territory of the Baltimore & Ohio which I cover, I have tried to keep down the camp situation as much as possible and shorten up the territories so the men can

get home whenever it is possible, without loss of time. We find it is more satisfactory, and we are able to hold the men together better. However, it is customary to furnish a cook in camps where we have to keep the men in them working a little overtime to make up for the lost time of the cook. The sanitary arrangements around the camps are important, but the most important thing of all in holding men is to allow them to get home as often as possible.

W. E. Alexander:—Mr. Pickering made some remarks about women cooks which I fully agree with. We tried that for some time on our road, having a man and his wife, who were good, efficient workers. The wife did the cooking and the man did the chores around the camp. He did this sometimes on his own time, as there was enough time and he got full wages for working outside and the wife got full wages for the cooking. That was very satisfactory, and as Mr. Pickering said, the morale of the men was better, the cars were more homelike; there were curtains on the windows, and little pictures on the wall, just like home. We had satisfactory service then, but it was easier to hold men at that time than it is now. Under the same conditions we no doubt would have a harder time to hold the men now. We have old coaches and old sleeping cars in our outfits. We have two old coaches, one fitted for a living car, and one for a dining and cooking car, and then we have a tool car (a strong box car that is probably out of date for the best service), and a flat car to carry the material. It requires four cars for the crew. The cars are not strong, hence they are placed in the rear of the train.

The President:—I want to say as to the question of women cooks, this country is a pretty big country and standards of morals are different in different parts of the country. Having spent the first 23 years of my life in the East and the last 17 years in the West, I have seen the contrast. Just within the last week my brother and his wife moved from Boston to St. Louis. They went to a boarding house there while looking for permanent quarters, and she has been horrified at many things that to some of us in the West seem entirely proper.

Now on a good many of the railroads in the West they have had women cooks in the past, and as a result of some such experience as Mr. Alexander has reported, the women cooks have been ruled out of line. Perhaps the trouble, or part of it, out here is that the younger men get to be foremen, while in the East

the men are older before they get to be foremen; their wives are mothers maybe, and they are absolutely above reproach. Now if some foreman has young ideas and marries a young wife, she would be the wrong kind of a woman to have on the boarding outfit in the West. A young woman has no place whatever on the boarding car. The older men with their wives are the ones—they add a touch of home, and keep the men where they otherwise could not be kept. In each case the personality, the character and the age of the woman should be considered, and where that is done I think it is a very good thing to get women cooks and it will add to the efficiency of the gang in every case.

SNOWSHEDS

By Geo. W. Rear

General Bridge Inspector, Southern Pacific, San Francisco, Cal.

Few members of the Association have snowsheds to maintain and it may be well at the outset to say that those who have not are not missing much. They are not an attraction in any way, being far from ornamental and are in most ways a genuine nuisance. Such being the case, there must be some cause for their existence. There is such a reason—they keep the snow off the track.

It will be noticed that these sheds are used only in the mountains in the western part of Canada and the United States, and investigation shows that in these mountains there is the greatest known annual snow-fall, especially in central California where the Southern Pacific crosses the Sierra Nevada mountains. The following figures show the annual snow-fall at various points along the line and the photographs give an idea of what the country looks like when covered with snow.

Station	Elevation	No. Years Record	Average Seasonal Snowfall
Blue Canyon	4695 ft.	14	17 ft. 3 in.
Cisco	5939 "	33	30 " 10 "
Emigrant Gap	5230 "	29	23 " 7 "
Summit	7017 "	44	35 " 0 "
Truckee	5819 "	35	16 " 0 "

Truckee is at the eastern base of the range and gets less snow-fall than stations at the same elevation on the western slope. This is due to the fact that the clouds move easterly from the Pacific coast and drop their moisture before getting over the range. The moisture is deposited in the form of rain to an elevation of about 3500 ft., snow seldom extending below that height in this latitude. The maximum snow-fall at Summit occurred in 1879-80 in which year 65¼ ft. fell, but this record was nearly reached again in 1890 when 64⅔ ft. fell.

This snow falls in a period of about three months and very little goes off during the winter, although it keeps settling down until the average depth on the level is about 15 ft., although 26 ft. has been measured on the level many times. This makes the snow very heavy, with streaks of ice in it, and it is hard to handle with plows. Rotary plows are used in the territory at each end of the sheds where the snow-fall is less. On certain slopes and in certain canyons the snow piles up to great heights, well onto 100 ft. deep.

The snowsheds in this territory are built of wood and are of two general types: (1) Those designed to keep snow off the track only. (2) Those designed to convey snow and snow-slides over the track. There are 30 miles of these sheds in all, covering a territory of about 40 miles, there being some breaks near the lower ends where the snow-fall is less and where sheds are used in cuts only.

The first sheds were built in 1868, the frames being constructed of round timber cut alongside the track and the sheathing being cut in neighboring sawmills. They are of the pitch roof type as shown in the diagrams. They had the fault of crowding out of line when unevenly loaded with snow and were extremely hard to restore to line. It will be noted that the vertical clearance was only 17 ft. in 1868 but this

Fig. 1. Original Snow Shed, Sierra Nevada Mountains, 1868, Southern Pacific Co.

provided nearly as much clearance above the cars as our present 22 ft. measurement does above modern cars.

The sheds were no sooner built than complaints were made that they shut off the view and many efforts were made to overcome this objection. Windows were put in at the most interesting points and shutters, that could be opened in the summer, were tried but for some cause or another all had to be abandoned, until the scheme of placing vertical slats something like a picket fence opposite the car windows was adopted. They are now put in wherever possible, except of course, where there is nothing to see in any case. They give a rather tantalizing view of some beautiful scenery and cause it to resemble moving pictures somewhat. However, they provide the maximum view and yet keep out the snow.

When it became necessary to renew some of the sheds, the present flat roof type was developed and this has been in successful use for many years. One of its principal advantages is the ease which it can be lined up if crowded over by the weight of snow slides. Variations of this type of shed are shown in the accompanying diagrams and photographs.

There are approximately 100 million feet of lumber in these sheds and outside of damage from fire their life is about 27 years. The fire risk is somewhat great, largely due to fires started from the outside. The large timber has been cut in this neighborhood, but there is considerable brush, which takes fire, usually from fires left by careless campers. While the risk is, thus, somewhat great, the fire loss is small, owing to the precautions taken to prevent its spreading.

In the longer stretches of the sheds, telescoping sections 100 ft. long are built as often as feasible. These sections are mounted on wheels and are rolled back into enlarged sections of the adjacent shed during the summer, making a break of 100 ft. These telescopes divide the sheds into short pieces, so that no great length is liable to burn at one time. It should be understood that a fire in these sheds burns the track ties and ties the rail in knots, destroying not only the shed but the track, so the fire losses are more serious than the actual value of the sheds alone would indicate.

To detect fires, a system of patrol is maintained, each patrolman reporting at an alarm box every hour. These alarm boxes are a little less than a mile apart and each report is registered automatically on a tape which is under constant observation at Summit station and is duplicated in the roadmaster's office at Truckee. When an alarm is rung in, the nearest fire train is notified and the main line is cleared of traffic. (The line is single track but, with sidings every two miles, little time is

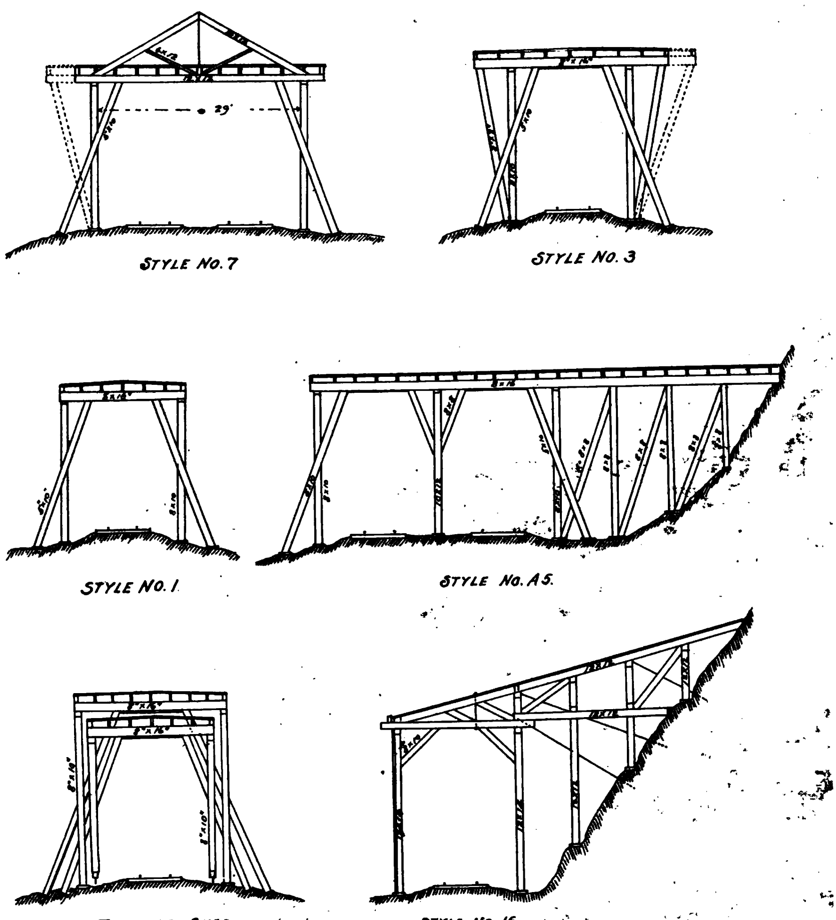


Fig. 2. Typical Snow Sheds, Southern Pacific Co.

lost in getting trains into clear.) There are four fire trains in service during the summer, each consisting of a locomotive, a pump and two cars of water having a capacity of about 20,000 gal. These trains are constantly under steam and ready to start on an instant's notice. The locomotives are equipped with high pitched whistles which are blown almost continuously while the trains are running, enabling workmen to get out of the way. It is reported that no fire has yet gotten by the fire train after it arrived at the scene of the fire.

In addition to these precautions a lookout station is maintained on Red Mountain at an elevaton of 7860 ft., from which point almost all of the 27 miles of the sheds can be seen, there being only two small sections hidden by spurs of the mountain range. At this lookout station two men are on constant watch, reporting by telephone every half hour. They have an engineer's transit mounted in their cabin, to which is attached an aluminum pointer which travels over a chart attached to a stand in front of the transit. There is also a line etched on the bay window of the cabin, which shows the lines of the sheds as seen through the transit. By training the transit on the fire the indicator will point out exactly what part of the shed is on fire or nearest to the fire, if it is not actually in the sheds.

These sheds are built to sustain 25 feet of snow, weighing 25 lb. per cubic foot and, as the territory through which they pass has very little wind and the snow is soft and sticky, great loads of snow rest on the sheds, especially in cuts. Some trouble was experienced in early years due to the snow combing and extending a considerable distance out from the edge of the roof. This was overcome by nailing vertical boards about 8 ft. apart extending about 8 ft. above the eaves.

In this range of mountains there are some snow slides, which usually carry with them large boulders. Where they are likely to occur special types of sheds with sloping roofs are provided. At odd times

Fig. 3. Reinforced Concrete Snow Shed, Union Pacific R. R.

though slides occur at unexpected places and it is on these occasions that the merit of the wooden sheds is appreciated. When the entanglement of snow, brush, boulders and sheds is observed, one wonders how the situation could be handled if concrete and steel were also mixed with it. Notwithstanding this, there is no doubt but that concrete sheds will be used in this locality in the near future.

The Union Pacific is building some concrete snow sheds in Wyoming, but conditions are different in that locality. Their trouble is from drifting snow which, in its travels across the plains gathers up so much sand that when it fills the cuts it is nearly 50 per cent sand and ordinary snow-handling apparatus is nearly useless. An illustration of their shed is shown in Fig. 3, page 170.

Sheds are also used in Washington and British Columbia and are of a very much heavier type as they are intended to retain the sliding hills as well as the sliding snow, but the writer has been unable to get any plans of them.

It is believed that the plans and photographs attached will give a better idea of the appearance of the sheds than a written description.

Fig. 4. Rotary Snow Plow

Fig. 5. Rotary Snow Plow in Action

Fig. 6. Entrance to Snow Shed, Southern Pacific Co.

Fig. 7

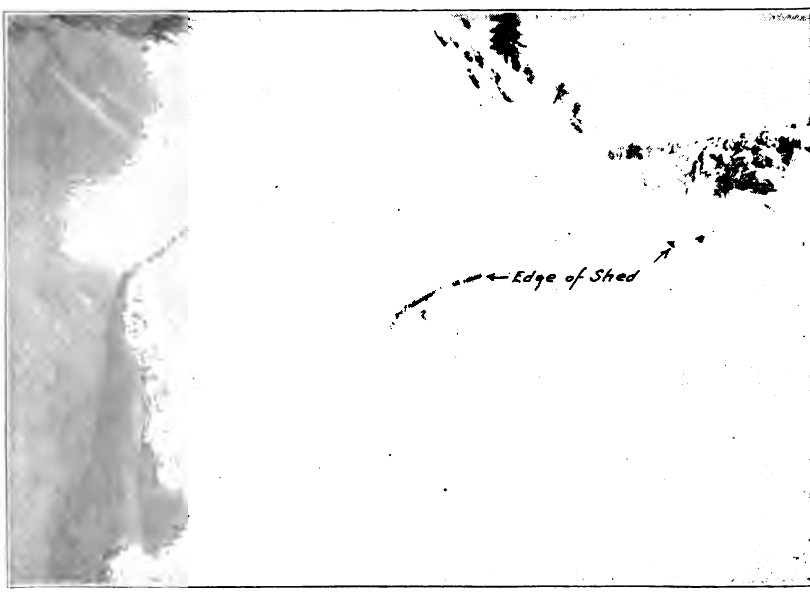


Fig. 8. Snow Covered Sheds, Southern Pacific Co.

FIREPROOFING ROOFS OF WOODEN BUILDINGS

COMMITTEE REPORT

This subject will be considered only with reference to the fire-resisting qualities of various solutions, coatings and coverings which have properties capable of withstanding fire coming in contact from without. Tile and other cumbersome materials not suitable for wooden buildings will not be considered.

Wooden shingles were used almost universally in the earlier days of railroads for the covering of all ordinary buildings having roofs with a pitch greater than one-fourth, and while they are rapidly losing favor there are certain localities where they will be used for some time to come owing to their moderate cost, light weight, low heat conductivity, wide application and durability. When shingles get old they become a considerable fire risk and are set on fire readily by sparks from passing locomotives. While there are a number of preparations on the market for making them fire-resisting to a considerable degree they are likely to be negelected beyond the length of time the preparation remains effective and the roof thus again becomes a fire risk.

In making wooden shingles fire resistant, Henry A. Gardner, assistant director of the Institute of Industrial Research, Washington, D. C., in a paper read before the 1914 convention of the Master House Painters and Decorators' Association of Pennsylvania, stated in part as follows: "At various times there have been placed upon the market fire-retarding solutions which have had more or less merit for the individual purpose. They consisted usually of water solutions of various salts, which, when applied to canvas, scenery, or like materials, would dry and leave the material coated or impregnated with a quantity of the dried salts used in making the preparations. In treating wood or cloth with such salts, it was generally found necessary to apply several coats of the solution, sometimes as high as six or eight, in order to get satisfactory results." After naming a variety of compounds that are commonly used Mr. Gardner stated that sodium chloride (common salt) is one of the cheapest mineral salts and quite as effective as many of the others.

From the book entitled "Fire Prevention and Fire Protection" by Freitag (John Wiley & Sons, publishers), pages 838 and 839, we quote in part: "So-called fireproof paints or cold-water compounds which are sold under a variety of trade names, all claiming fire-resisting properties, should be classed as fire-retardants rather than as fireproof. While wood or other combustible materials which have been coated with such compounds will withstand the blaze of a match successfully, a few minutes' exposure to a greater heat, as of a lamp, will show that no great degree of fire-resistance exists. However, the preventive value of such coatings is material, especially for scenery, properties, and other stage fittings, that the quick spread or 'flash' of fire over such materials will be greatly retarded, if not prevented altogether. The use of fire-retarding paints or solutions is, therefore, to be strongly recommended for scenery, etc., whether required by law or not."

Believing that it was the intention that this report should give more consideration to coverings which are in competition with the wooden shingle we will proceed in that direction.

Coverings prepared by saturating felt with asphalt, sometimes termed "composition roofings" or "prepared roofings" are sufficiently fire-resisting for all practical purposes, and on buildings which have a pitch of one-fourth or greater and where appearance need not be taken

into consideration, such material laid from rolls in large sheets with 2-in. lap joints may answer the purpose as well as anything. These ready roofings are also put up in the form of shingles, which, if properly laid, make a very good appearance and will last from 6 to 15 years, depending on the quality of the materials used in their composition. The trouble with the ready roofings is that, when the oil dries out of the asphalt, the felt becomes dry and brittle and the life of the covering is at its end.

Most wooden buildings with flat roofs or roofs with a slight pitch are best covered with tar and gravel or metal, the former being generally used on main buildings and tin in sheets on porch roofs and other places where tar and gravel would be objectionable.

Shingles made from a composition of cement, asbestos, etc., and having various trade names, are used to a considerable extent and they present a good appearance. These have not been in extensive use long enough to determine how long they will last, but up to the present time they seem to be a good substitute for slate and are not as easily broken. They have been in general use only from 5 to 10 years.

Slate shingles have been in use for many years and for roofs having more than a moderate pitch they are perhaps as durable as anything on the market, or much more so. In cold climates where the pitch of a slate roof is less than one-third or one-fourth slate often proves troublesome, as, where heat from beneath melts snow which has lodged on the roof, it holds the water in suspension while it finds its way under the slate by capillary attraction and if freezing occurs before the water runs off it invariably breaks the slate shingles in great numbers. This will cause a leaky roof, or the roof may leak under these conditions without the slate being broken if the felt undercovering does not give the required protection. This melting and freezing condition is quite common where the roof continues from a warm building to broad eaves or sheds where it is cold underneath and more especially if there is a break in the pitch of the roof at the eaves.

Tin shingles are used to a considerable extent on some roads and give good satisfaction. When secured with the "bar lock" it is impossible for a tin roof to leak during its lifetime. These shingles are manufactured in various ornamental styles and make a neater appearance than any other kind of ordinary metal covering. Their life on railroad buildings depends entirely on the kind of metal and its protective coatings,—tin, galvanizing, paint, etc.

Galvanized iron, laid in sheets with seams running vertically, has been used to a considerable extent and will last a long time if painted about every three years but it does not present as good an appearance as ornamental tin shingles. These metal coverings are not nearly as durable as they were when wrought iron and old style tin were used. Tin or galvanized iron with soldered seams is often used on flat roofs and will last a long time if properly protected with paint.

The ordinary tar and gravel roof is probably more extensively used on roofs having a slight pitch than any other kind of covering and its wearing qualities are so well known as to require little comment. Its life depends solely on the quality of the materials used and their application.

Roof coverings which require protective coatings are at a decided disadvantage for the reason that they are liable to be neglected beyond the time when the coating remains effective when the covering suffers and may result in premature loss.

C. A. Lichty,
J. B. Gaut,
A. T. Hawk,
J. W. Miller,
P. Aagaard,
Committee.

DISCUSSION.

The President:—We have here to-day one of our members, a consulting timber engineer from St. Louis. I think Dr. von Schrenk knows more about timber than any other man I have ever met, and I would like to hear from him because I believe he has something to present to the association at this time.

H. von Schrenk:—What I heard this afternoon about the poor wooden shingle put me in a combative frame of mind. It reminds me of a story of a doctor on a train who went into the washroom and, seeing things lying around in a rather disorderly state, he began a tirade on the bacteria and the carelessness of people. Looking around he beheld the negro porter standing there with his brush, ready to brush him off. The doctor said, " There is one of the chief evils of the day." The negro heard him and he said, " Well, doctor, what little brushing I'se going to do to you fellows won't do you much hurt."

I want to comment briefly on the report of the committee, which I thoroughly approve of except for one paragraph, in which the chairman said they are going to consider the materials which are replacing wooden shingles as coverings. I don't quite like the exact language used. I would suggest that that possibly be changed or modified to substitute for the word "replace," the clause, "the materials which are in competition with wooden shingles."

I want to take a very few minutes of your time to present to you the preliminary results of an investigation we have been conducting for ten years in relation to the fire hazard of the wooden shingles. We started this 10 years ago with investigations in London and Berlin in an attempt to find some technical method of determining the fire-resistant qualities of different woods, but very few methods have been developed by which the ordinary man could tell from the thousand and one things offered to him which would be the most effective as a preventative of fire.

We are all familiar with the usual methods of testing different materials, of holding up a particular object and holding fire to it to see if it will burn. But all of those methods are subject to criticism, or, it might be said that they are not comparative tests, because in no two cases do you make the attempt in exactly the same way.

The first thing we tried to do was to formulate a method by which the ordinary person could determine the fire-resistant qualities of building materials. We started with the roof coverings, of course, because we thought they presented the highest degree of fire hazard. There ought to be no question among good, conscientious citizens but that an unprotected wooden shingle should not be used in a position where the hazard is so high. But the high qualities of the shingle, its availability,—you can get them all over the country,—and its low cost, all have made it so acceptable as a building material that the public is going to use it for a good many years to come, in spite of its one defect.

Our problem was to overcome that defect. I have brought here with me to-day some sample roof sections which tell the story much better than anything I can possibly explain to you. With the coöperation of the National Paint Manufacturers' Association we finally developed a paint which sells for considerably less than the high grade lead and zinc paint, and which is composed of about 50 per cent asbestine, the pigments making it a red, slate colored, gray, or tan paint which is applied as a priming coat first of all by dipping the shingles into it. The prospect is, at the present time, that this will be done at the point of origin, so that the shingles will already be dipped when you buy them. Then when they are put on the roof another coat is applied.

We have constructed a number of these small shingle decks which are placed at the end of a long box, through which we cause air to go at a velocity of three, four or five miles an hour. Then we put on a brand. We made a lot of experiments to determine the kind of wood the brand was to be, and we finally decided upon white oak. This brand is ignited and placed upon that deck, and we had to make it so large that it would invariably burn up an untreated roof, because it had to be severe enough to burn up the brand used in making the experiment.

I realize the weight of that brand is probably greater than that of brands which usually give rise to conflagrations, but the experiments which we made were conducted by members of the Government and before eminent engineers, and they all seemed to think that the test was not too severe.

The untreated roof will burn up in 15 or 20 min. if allowed to continue, but in 99 cases out of 100 on the painted roof the

fire will go out after the brand has burned out. Without trying to make invidious comparisons, I have put on the table a series of fires which have been classed as the fault of the roofs, not to show that some of those roofs are not good, but simply to show the relative degree of resistance between the many prepared shingles and the asphalt, for instance. The asphalt shingle, in nine cases out of ten, will burn through.

We are putting out hundreds of large test decks at our laboratories in St. Louis for the purpose of exposing them to fire and to determine the relative resistance of certain materials we are going to make tests of. Those tests will all be made in our own furnace or in the Underwriters' Laboratories in Chicago. We are furthermore putting out several hundred smaller test sections. They will be burned every few months.

I have also put upon the table a rather interesting paint which we became interested in, largely through the demand which the Government has lately made in connection with the construction of the large warehouses and cantonments all over the United States, with reference to painting the interiors of the buildings. I thought you might be interested in trying out paint of that sort, particularly the white paint which I have put there. Of course, that is not the only paint. There are a number of different kinds offered for sale over the country which have a tremendous degree of fire resistance. Ordinary Government whitewash is one of them, although it is not so good as some others.

Those compounds, of course, are unfit for the roof covering, because the primal requirement for a roof covering is a fire-retarding quality. It must be cheap and it must not contaminate the water which runs off the roof. But one advantage of that is its high degree of permanency. Five years is a safe period for the exposing of that paint. From all the shingles I have examined on the roof, I am convinced that the painted shingle never curves, thereby materially reducing that hazard which comes up with the unpainted shingle. That is another point in favor of the painted shingle.

While I am on my feet I want to express my appreciation to the committee on paint in connection with the way they have carried out the idea of the primer coat. We have discovered that the chemical formula of paint has practically nothing to do with its adhering qualities or the lasting power of the paint.

The great factor is in the care of the priming coat. I heartily agree with Mr. Ettinger that instead of covering the building with one heavy coat of paint, I would rather go over it five times, because the sticking capacity, where care has been used in the principles of the priming coat, is so patent that it should be known to everyone.

The Secretary:—Mr. President, I believe that all our members will agree with me that Dr. von Schrenk knows what he is talking about or he wouldn't be employed by the Government in making some of these tests. The committee will revise its report to make it agree with the tests which he has to show, as far as they bear upon this report. There is no doubt but that a wooden shingle, if handled rightly in the first place, can be made sufficiently fire-resistant to withstand the ordinary fire test.

P. J. O'Neill:—It seems to me that we are confronted with the old question of theory versus practice. Dr. von Schrenk tells us they are going to furnish us a way that is different, but the proper way to apply paint is "a strong arm on a good brush." The way to get the paint on to stay is to rub it on. We have abandoned the practice of painting wooden roofs on the New York Central because in applying the paint to the roof a little dam forms along the base of the shingles that retards the water, causing it to soak into the shingle. In a few years they rot off. I consider the old method of painting the roof is a detriment to it.

UNIFORM VERSUS DIFFERENTIAL RATES FOR BRIDGE AND BUILDING DEPARTMENT EMPLOYEES

By E. T. Howson
Editor, Railway Maintenance Engineer, Chicago, Ill.

The bridge and building department in common with other branches of the maintenance of way department, is experiencing serious difficulty at present in retaining adequate forces. The competition for men has become unusually keen, particularly since July 1 of this year when the construction of the cantonments and other concentration camps for military forces called for large numbers of carpenters and other skilled mechanics at wages far above those which the railroads were paying. However, in spite of its present acuteness this problem is not entirely a recent one, but it has been developing for many years. The present abnormal conditions are only revealing more prominently the fact that at each recurring period of prosperity, the railroads lose their men to other industries, which indicates that they are not meeting the competition of other employers successfully. Primarily this is a question of wages and this fact leads to a consideration of the present basis of wage rates on the railroads.

The principle upon which wages in the maintenance of way department are based is that of a flat or uniform rate for every man. This in turn presupposes that all men are worth equal amounts or that they are of equal ability and efficiency. It is primarily because of this foundation that difficulty has arisen in retaining forces, for when a man realizes that increased experience and greater effort are not rewarded, he either reduces his pace to that of the rest of the gang or, if ambitious, he goes to another industry where his efforts are more adequately rewarded. In either case, the company loses the benefit of his greater exertion.

Furthermore the railways have not kept pace in the last few years with the rapid increase in the wages of skilled workmen in other industries. In many cases it has been considered impractical to raise the wages of the large numbers of men employed because of the expense involved, while in others the disinclination to disturb relations with the wages of other employees has tended to hold all of them stationary. The result has been that the outside industries have been able, through their higher wages, to attract the best men, leaving the less efficient to the roads.

All of these conditions have acted to the detriment of the bridge and building department and have affected the efficiency of the forces adversely. In view of the present almost universal shortage of men, it is, therefore, particularly important at present to consider ways in which this tendency can be arrested.

One suggestion which has been made to meet this condition is that of establishing different rates for the men in the gangs, which rates could be so arranged that while the total payroll for the gang would not be increased, the men would be paid in proportion to their experience. In other words, instead of paying a flat rate of perhaps 30 cents per hour for all men in a gang, good, bad and indifferent, experienced and inexperienced, a few men might be paid 35 cents or 40 cents per hour, others less experienced, 30 cents, and the remainder of the gang

would be composed of ordinary laborers, who would be paid the prevailing laborers' rate of perhaps 25 cents. In this way, it would be possible to retain a nucleus of efficient men in each gang as their wages would compare favorably with those in competing industries. These men should set the pace for the entire gang including the laborers who should be little, if any, less efficient than the inexperienced men now composing the larger part of the forces in nearly every gang. A graduated rate can also be held out to the newer men in the gang as a reward for experience and as an incentive for them to put forth their best efforts. In other words, the tendency of such a plan is to hold both the inexperienced and the experienced men, a thing much to be desired.

One objection to this system which has very largely retarded its adoption is the fact that the establishment of a higher rate for one group of men disturbs relations with other groups. Regardless of the merits of the contention of any group of employees, the raising of their rates enables other groups to argue that their work is as important relatively and that they are also entitled to increased pay and it is very difficult to refute such arguments.

An even more serious objection to the differential rate is the tendency of some foremen and not a few supervisors to use such a differential as a means of securing higher wages for as many of their men as possible without regard to their merit or the purpose of the differential. If this plan is admnistered in such a way the only result is to increase the payroll without securing a corresponding return and the plan defeats itself.

In spite of these handicaps a differential wage rate adjusted to the merits of the different classes of employes has much to commend it particularly at the present time when labor is so scarce and so nomadic. If fairly and intelligently administered, it will benefit a road by enabling it to meet the competition of industries to a greater extent than is now possible, while it holds out the promise of reward to the younger and less experienced but ambitious workmen.

This is not an untried theory for at least one road. The St. Louis-San Francisco adopted the plan of paying differential rates for its bridge, building, painting and concrete forces over a year ago with excellent results. The most experienced carpenters and painters are now paid 35 cents per hour. A second rate of 30 cents per hour is paid for less efficient men while general handy men are paid 27½ cents and laborers from 15 cents to 25 cents, depending upon the locality. These rates have enabled the road to secure and hold a much better class of men than formerly and as a result more work has been done by this force this year than in any similar period in the history of the road. The officers in charge of this branch of maintenance work state that if this plan had not been in effect, much of this work now completed would have had to be left undone because of lack of forces. The statement is further made that this plan has been shown to be economical to the road.

As an instance of the manner in which the men regard this method of payment, the Frisco sent a gang of 50 men to Fort Sill this summer where the government was hiring every man it could at rates almost twice those being paid by the road. In spite of this fact, the road did not lose a single man from the gang, although it contained some of the best carpenters in its employ.

DISCUSSION

E. T. Howson:—It seems to me from the discussion this morning that the idea of the program committee that we spend a half day on the consideration of the labor situation has been

vindicated by the information brought out. Every man I have talked with seems to be up against it for labor. It is a universal complaint. But I believe the present labor shortage is going to be a blessing in disguise to the roads, and the bridge and building men primarily because it is focusing attention upon one of the sore spots in maintenance operations and is going to bring about reforms that are going to be of permanent benefit after this shortage has disappeared. Also, I think it is going to be well for us to prepare for a shortage of labor for several years. I think it will be indefinite,—we can't say how long. The war will close, but the Alien Labor Law and other conditions are shutting off the immigration of large numbers of men into this country and that is going to create a shortage in all branches. It may not affect the bridge men immediately but it will ultimately.

A man asked me the other day what I thought were the essential elements in the solution of the labor problem, and I listed three things,—Adequate Wages; Permanency of Employment, and Good Living Conditions. It seems to me that the other defects hinge around those three. We have spent a large part of the morning very properly upon living conditions, but there are other phases, one of which is the wage situation, and just one angle of that is treated in this paper.

One very important consideration in this labor situation that this plan of increasing rates for length of service tends to improve is the labor turn-over. Every one realizes that it costs a lot of money to train a man. The present practice is to train the men for a contractor to take when they become skilled. The road assumes the expense of developing a man into a semi-efficient workman and is then unable to hold him in competition with other industries. Some of the factories figure it costs from $75 to $200 to train a man into an efficient employee. I don't know of any railroad that has ever endeavored to arrive at the cost of training a man to be an efficient carpenter, but the cost is there just the same. The continual changing of forces is one of the most expensive features of maintenance work.

An officer of the Pennsylvania Railroad read a paper at the National Safety Conference in New York recently in which he gave some figures on the cost of turn-over. This road employs about 450,000 men in the maintenance of way department, and 400,000 of them are new every year. The average length of service of the maintenance of way employee is about 13 months.

The President:—I don't know how many of you gentlemen have given thought and consideration to the so-called Differential Rate and Sliding Scale of Wages, but I think it a very important matter and that it ought to be followed out in many lines, and I think it can be well applied in the bridge and building department. There is no reason why a certain fixed rate should be paid to a man in the first year and the same in the fifth and the same in the tenth year, and the only hope of a man getting away from it is that he might get to be a foreman and be put on a different arbitrary rate.

There should be a sliding scale extending over so many years, by means of which at the end of every year a man would have an increase of one cent, we might say, and at the end of two years, an increase of two cents, and so on. A man in service 10 years would be getting 10 cents an hour more than the man who was just starting, and that would go far toward making the men satisfied and keeping them from unionizing. The higher wage men, who have been in service the longest, the older men, would not be interested in any agitators that might talk to them. Some of the younger men might, but the older men would stay, and you could get along without the younger men and get others to take their places. I think one of the things that should be given more consideration than it has been given in the past, is the Sliding Scale of Wages.

The line that I think of now where it is being followed to the greatest extent is among the motormen and conductors on street railways in almost every city and street railway in the United States. They start on a fixed rate, the next year they get a little more, and the next a little more than the last, and some of them increase up to the 15th year. It is remarkable to compare the seniority list of roads which have the sliding scale with the seniority list of roads which have a flat rate. Those roads which have the flat rate have a lot of men working for them only a few months, whereas the roads employing the sliding scale have had a lot of their men with them over a period of eight or ten years.

F. L. Burrell:—We have tried the sliding scale on our division for six or seven years, and we find it an advantage.

Once in a while a man will say he has to have more pay. As I look at it, the way to handle those cases is the way I handled that of a man who came to me and said, "I have been getting 30 cents an hour, and if you can not give me 35 I am go-

ing to quit." "Well," I said, "let's go in the office and talk it over." When we were in the office I said, "I want to tell you something. I have tried you out. I have sent you out to do work and you have not fulfilled my expectations. Now if I send you out with a foreman getting $100 a month and you can't do the work after you have had a year or two of experience, do you think you are entitled to 35 cents?" "Yes," he said, "I do." "Well," I said, "let's put it another way. Suppose you employ me and you are paying the money out. If you found I could not go out and do an ordinary piece of work after two years' experience with a man with you to show you how, who was getting $100 a month, would you consider that I was being treated fairly or unfairly?" "Oh," he said, "I wouldn't want to pay you any more." "Well," I said, " you go to work again." He went to work again and he stayed. I believe we can talk to these men individually and get results.

G. W. Andrews:—The Baltimore & Ohio adopted the sliding scale or differential rate 15 years ago, and as a whole has found it very satisfactory. There have been exceptional cases, as you will find under all conditions, where some of the employing officers find that they can get a good man and have employed him at the higher rate. In some cases that has caused dissatisfaction among those getting the lower rate. However, as a whole, the tendency has been to raise the man from the lower rate gradually to the higher rate, and we have today a number of men getting the higher rate whom we employed at the lower labor rate 10 or 15 years ago. They understood that an increase in their salary depended almost entirely upon their own energy and ambition, and they have looked at it in the right light. I feel safe in saying,—and I believe our master carpenter will bear me out,—that a great many of these men today are the most valuable men we have.

A great many young men coming on now can not understand why, if they are holding up their end of the work, they should not get the same wage as the other man does, but when the matter is explained to them fully and clearly, most invariably it brings about the proper results. It isn't difficult to explain his lack of efficiency and his lack of knowledge and experience to the ordinary man, and when that is done and he is beginning to feel that it will come to him just as soon as he proves himself capable, he starts in with the determination to

win. We have among our best master carpenters, a man who started in as a laborer, at a laborer's rate, and soon developed into an efficient carpenter, a leader of the gang, a foreman, and later a master carpenter. Personally, I believe as a whole that the differential or sliding rate has been not only successful but fairly efficient.

A. S. Markley:—Is there a limit to the highest wages paid, or the number of men who shall receive the higher wage, or will they all come up eventually?

G. W. Andrews:—The manner in which we started it was to state that a certain number of the men in the gang, being leading men, would get the higher or maximum rate; a certain number would get the middle rate and a certain number the lower or minimum rate. The higher rate was a considerable advance over the ordinary laborer's rate paid, and the men were selected as a rule from those who had been employed as laborers. That left only a certain number who could be advanced to the higher rate, but that is being remedied by giving authority to increase the men to higher rates when they prove that the company is justified in paying that rate.

We are now, like everybody else, laboring under the greatest difficulties, in retaining men at any rate that the company feels capable of paying.

The President:—I would say, in reply to Mr. Markley's request, that in asking whether or not the number of men getting any particular rate should be limited, where the sliding scale on a seniority basis has been adopted, where the men get a certain rate the first year and a higher rate the second, etc.,—there has been no limit to the number, for the reason that the companies have presumably thought it would benefit them in order to get more of the older men into it.

L. D. Hadwen:—I concur very heartily with Mr. Howson in thinking that the differential rate is one of the best means of building up a sound organization in crews of any kind. There is one feature that he did not mention that I would like to emphasize, and that is, we should not consider one rate fixed by the conditions in one locality as an excuse for the same rate being used on a different section of the division or a different portion of the system for similar work, where labor conditions may be very much easier. I think that fact should be borne in mind in considering the question of rates. We, in our construction work,

are permitted a certain amount of leeway in fixing the rates in the crews, and my experience has been that there is nothing more helpful than having the men know that their worth will be appreciated, that they will have opportunities for advancement, and that the man who is more efficient will receive a higher wage than the one who is merely a laborer, working from day to day.

E. T. Howson:—A large part of our troubles with labor at present have arisen because we are using antiquated methods of 20, 25 or 30 years ago. Labor conditions have changed. Men have become much more scarce and we are now confronted with a different situation than we were years ago when we could get all the men we wanted. Now the men are in demand, and we have got to consider that they are men. We have got to handle them in the same way. A man is looking for some method of advancement, and, as a matter of fact, the man who isn't looking for advancement is not a good man to have in the gang. We should not expect a man to live under conditions in which we would not live. The men in the gangs are "men," and should be treated as such. We have got to give them conditions that will appeal to them the same as to you or to me, and when we reach them on that basis, it will go a long way toward solving the problems.

In many instances the higher priced man is the cheaper man. It requires supervision to see that the foreman does not ask for higher wages for everybody, however.

I think we are going to come to the point where we are going to use fewer men and a better grade of men. The railroads have been particularly extravagant in the use of men. They have not been up to the standards of other industries, but they have got to come to the use of more labor saving equipment.

J. B. Sheldon:—The railroad with which I am connected has a maximum wage for the highest grade men. It has been my practice for a good part of a century to grade the men, as far as I could, under the conditions in which they worked. I have taken the young, inexperienced man from the farm or the shop, and increased his wages as he developed in skill. We are handicapped, perhaps, by having a maximum wage, but it has worked out very nicely. As a result, I have men who have been with me for more than 25 years. Many of them who started at the

bottom have developed into our most efficient men, and we have scores of them who have been with us 10 or 15 years. The sliding scale gives us a chance to hold the men and keep them satisfied.

That sliding scale has been interrupted somewhat in the last year or two on account of the labor situation, because we are unable to get anybody to do anything for less than the maximum wage. That has had its disrupting effect on the older men; but as a general proposition the sliding scale or the differential rate is founded on solid business principles and will give the best results all round.

B. F. Pickering:—I heartily concur with what has been said with regard to the differential rate. It is a well-known fact among all supervisors and superintendents of bridges and buildings that the ordinary house carpenter, as employed by the contractor in building work is not always the most efficient bridge man. In fact, we have to train many of them for our work before they are very much good to us. I have found in my experience that the best men that I have to-day are many of them, men whom I took as green country boys, employed them at laborer's rates, and as they learned our business, advanced them from one stage to another. In fact, one of my most efficient foremen to-day is a man whom I employed as a laborer when he was perhaps 19 or 20 years of age, and he has been advanced constantly.

There are, of course, objections to this plan. It puts a great amount of responsibility on the supervisor, because not all of the foremen see the system as a supervisor does and they want all their men to get the highest rate.

Another point I would like to bring out is that the so-called sliding scale or the differential rate should not be based upon length of service. For instance, I have some men in my gangs who are employed as helpers and have been for years, and while they are most efficient helpers, they will never be able to take a mechanic's rating. I think the promotion from one wage rate to another should be based almost entirely on the efficiency of the men and the spirit which they manifest in the work that is assigned them. If they are interested, if they try to do their best, if they are putting forth every energy in their power to do the company's service as they would if it was their own business, these men are certainly entitled to some consider-

ation, and while other men alongside of them may be doing just enough to get by and not receive any censure for not doing their best, at the end of a specified time if the man who is working for you and giving all he can, is not advanced over the man who is not, it is manifestly unjust. The man who is giving his life to the service should be the man who is advanced. The man who is doing just as little as he can and not merit a calling down, should be kept in the position he is in until he shows a disposition to improve and do his best. As I said before, that puts a great weight of responsibility on the supervisor.

There is another phase of the question that we are up against in the east, and that is the labor organizations. A bridge gang is usually composed of from 8 to 12 men. Perhaps two or three or four of these men will be rated as carpenters, and yet they get a lower rate than the highest paid men. Then the labor agitator comes along (and the labor union is pretty strong in the east) and he says, "Here is John; why doesn't he get as much pay as Jim; he does the same work?" The labor organization never takes into consideration the efficiency, the spirit and the honesty of the man. To the labor agitator it is simply that one man is the same as another man and if he is rated as a carpenter he should get the highest carpenter's rate of pay.

We have to fight against those things, and we have to do it by humane principles. We have to do it by showing our men that it is our interest in them and their interest in our work that shall enable them to advance by merit, by efficiency, by earnest, conscientious service, and not by union rules.

W. E. Alexander:—I have had charge of men ever since I was big enough, and I never had charge of a crew on a flat rate. I never was in charge of a crew in which there was not some differential in the wage. I have not been tied up with organizations to such an extent as to have to pay the poor man the same as the good man. That hampers the organization. The flat rate is the thing that demoralizes labor, because the poor man will do no more than he did before, and the good man will do only as much.

HOW TO SECURE AND HOLD BRIDGE AND BUILDING MEN

By J. P. Wood

Supervisor of Bridges and Buildings, Pere Marquette, Saginaw, Mich.

The problem of securing and holding bridge and building forces is the most serious of any that confronts this department at the present time, and I believe I am safe in saying that it is more serious at present than it has been at any other period in the history of railroading. It is the greatest worry that the supervisor has. He may think that the stores department is lax in securing his material and the operating department slow in moving it, yet without men he can do nothing with it after it arrives. If the railroads were allowed to raise the price of the commodity they have to sell the same as other corporations and firms have done, a better scale of wages could undoubtedly be secured, which would eliminate a large part of the trouble that we now encounter in securing men.

The old song we have all sung so often when hiring men that it is a year around job with practically no lost time and a few passes for a man and family each year does not make much of an impression on a man now as he can get a job that pays more in a factory or shop and at the same time be at home with his family. This applies more particularly to the city man than to those residing in the small towns and country. Many good men can be secured in the smaller towns where there is not enough work to keep them busy the year around if a judicious canvass is made by the supervisor and his foreman among the business men in these places who are usually willing to coöperate along these lines; and by having the local agent keep you posted as to the movements and whereabouts of the men you have in view, and as to the progress of building operations in that vicinity so that you will know at about what time these men will be out of employment and looking for more. Then is the opportune time to go scouting for them.

The city man constitutes a different problem as he is much more difficult to get in touch with. Yet by keeping in close touch with contractors and manufacturers who employ mechanical help, one can always secure a certain element that make good men for our class of work.

There is another point that I want to emphasize which applies both to securing and the holding of men and I believe it to be the most important of all. It is your reputation. I imagine some of you will smile at this statement, but when you stop and analyze it you cannot do otherwise than to agree with me that your reputation is of vast importance among your men. When your men come to realize that you are strictly honest with the company you represent, ever watchful to guard and protect its interests as you would your own; when they come to realize that you are just as careful to guard and protect their interests, ever ready and willing to take the lead in fighting their battles when their cause is just, ever willing to listen to their complaints and grievances and rendering your decisions in a manner that shows you have no favorites, and that the most menial laborer in the gang receives the same consideration that your best foreman does, that you are ever ready to advise and instruct, conducting yourself in such a manner that they see at once that you are made of the same kind of clay that they are, becoming acquainted with their family affairs so that you can share

in their joys and sympathize in their misfortunes; these are the things that command the respect and confidence of your men and build for you a reputation that goes out and reaches farther than the chair you occupy in your office.

Much can be said on how to hold men. I want to call your attention to some of the more important points. The supervisor should be a diplomat, as on his ability along these lines depends his success to a certain degree in holding the men. Also he must use great judgment in selecting a new foreman as on this choice rests his further success. The oldest man in point of service or the best mechanic does not always make the best foreman. Rather one should look for the one with the best executive ability, as he rarely fails.

When out where the work is in progress study your men as to their ability to perform their tasks and observe how they get along with other men; whether they are looking for something to do or have to be told. By constantly keeping watch of your men along these lines, when the time comes when you want a foreman your choice will probably have been made long before, and if you have chosen wisely a great part of your worry about holding the men has been eliminated, as the average man will overlook many things if he has a good foreman to work under.

Let the men go home as often as is possible if it is every night: they have wives and babies, mothers and sweethearts the same as you and I had when we were working in the gang. While you will have to use a certain amount of discretion in issuing passes don't be stingy with them. We are all aware that the prices of paper and of printing have advanced, also that the supply of good men is getting scarce and they are hard to procure; then why should we take any chances of losing a good man that it has cost the company dollars to educate for the sake of saving a few passes? The company might better furnish the passes.

Get the best equipment that you can for camp cars and make them as home-like as possible, looking well to the things that make for the comfort and health of your men, providing sanitary bunks, plenty of such utensils as are used in camp cars, good ventilation, as much room as is consistent with the number of men carried, not forgetting a liberal supply of brooms, mops, scrubbing brushes and paint, and insist upon absolute cleanliness in and about the camp, as it helps to keep the men satisfied.

Another point I wish to bring out is the use of labor saving machinery and devices, not only as a means of holding the men, but at the same time as a money saver for the company. While I am aware that it is sometimes a hard matter to get your superior officers to see these things as you do, yet with some effort on your part you will find means whereby you can lay the cold facts before them and usually win them to your point of view. Then it is an easy matter to place your order with a surer prospect of getting what you want, thereby reducing your cost of operation and keeping the men better satisfied.

These and many other things that can be done to better the conditions of your forces are what count for contentment among the men, and are appreciated by them. By keeping them contented and satisfied you will have less trouble in holding them.

WAGES AND TRANSPORTATION IMPORTANT

By W. E. Alexander

Superintendent of Bridges and Buildings, Bangor & Aroostook, Houlton, Me.

My experience in recent years has been with a railroad running through a sparsely settled country where there are not enough men even in normal years to carry on the regular business of farming, lum-

bering and manufacturing. These industries are therefore competing all the time for the best native labor. For this reason it is difficult to secure even the unskilled men we want at any time, and as there has been little railroad construction in recent years it is almost impossible to hire new men with any experience whatever in bridge work.

At certain seasons, farmers, lumbermen and millmen will offer much higher than the normal rate of wages, which induces the younger men to leave the railroad service with its lower rates of wages; and it is only occasionally that a man can be held until he is educated to fill the position of a bridge and building foreman. The members of this association will agree that this is an important position, and under present conditions of traffic needs a careful and competent man.

Men for our crews are hired from those who apply for such work, or from the general labor market wherever they may be picked up. When possible, they should be hired by the foreman under whom they are to work. The first consideration of the laboring man is the rate of wages. Unless the compensation offered is somewhere near the "going" rates in the country through which the road runs, it is obvious that the proper class of men cannot be secured, though I find men generally fair to make allowance for steady work and other benefits in railroad service.

The wage question at the present time is a most serious one for railroad managements. There is an unprecedented shortage of men. Railroads cannot afford to pay the high rates now paid by other industries. Where wage schedules are definitely fixed we must do the best we can with the rates allowed. In my opinion, wage schedules for bridge and building men should be on a sliding scale, rising gradually from the lowest rate paid beginners to the highest allowed; and the head of the department, in consultation with the bridge and building superintendent and after recommendation of the foreman, should have authority to advance any man to the higher rates of pay, up to the limit allowed by the schedule as he becomes fitted. This will stimulate the men to do better work and fit themselves for the higher grades. Further, in hiring men, they should be fully informed of the advantages that railroad work offers; steady work, regular pay, low cost of board in outfits, passes and other privileges.

How to hold men after they are hired is an open question in all departments. It is clear that most men leave for higher wages. If the railroads do not pay as high wages as other companies and individuals, a proportion of the men will leave. To hold the men then, it is absolutely necessary that the management be thoroughly informed of the situation by the men who actually know all the conditions, and allowance enough be made to hold the reasonable men. This should be done as soon as possible, so that men do not become dissatisfied, as it is much easier to hold good men than to get others to fill their places after they have gone. When they understand the privileges granted them including free transportation to go home as often as reasonable, free transportation for their families on the road they work on, refund on personal freight, etc., they are more likely to appreciate their jobs. A thorough understanding between the foreman and supervisors and the men produces the best results. The best methods of doing work also need to be applied, as this is best both for the companies and for the men. In short, if men are to be retained in railroad service, they must be paid wages that are reasonable in comparison with those in their territory and have fair treatment and steady employment, with a chance to advance in position and wages as they become fitted. Good working and living conditions and such privileges as can properly be accorded by the company are also very essential. This applies to all classes of men in railroad service.

PERMANENT WORK AND GOOD CAMPS ESSENTIAL

By F. L. Burrell

General Foreman Bridges and Buildings, Chicago & Northwestern, Fremont, Neb.

The prime factor in securing bridge men is the wages paid per hour. There is no use of expecting to get experienced men at green-hand prices, neither should one be expected to pay green men experienced men's wages. Therefore, the first step is to get a basis of wages at reasonable figures for the different classes of labor required.

The next step is to get the operating officials to allow the organizing of gangs early in the season. In making up the gangs have a personal talk with the men, collectively or individually, as the opportunity may present itself, and have it understood that no man is guaranteed long time employment but that the persons employing them will do all in their power to hold them continuously so long as they do their part by showing a desire to give a full day's work to the company; and that if any vacancies occur the older men in point of service will be promoted and get the higher wages that go with the positions, if they are competent to fill the place.

The person in charge should arrange his work to give the best men winter jobs. This is necessary on account of the probability of emergency work when the most experienced men and best workers are needed. This also gives them a chance to work up to the position of foreman.

The men we get now are not of the old rule-of-thumb class with the log fire or candle light education. Many are high school men, and they are not without ambitions, for most of them turn to farming or small machine shops of their own after they shall have reached a gang foreman's position, as there is poor prospect of further advance. This makes it necessary to keep good men to follow the retiring foremen.

One of the most necessary steps to take in holding men is with reference to the housing. If an outfit of bridge men is allowed to "bach" it in the cars there will be less trouble in holding the men. This requires three cars to the gang, one used for a cook and dining car. The men may get their own meals at a great deal less cost to them and at no more cost to the company, making it more satisfactory all around.

One of our gangs has a man who is a good worker as a bridge man, and who is also a good camp cook. He gets out at 5 a. m. and has breakfast out of the way and the men are on the job at 7 a. m. Supper is cooked after 6 p. m. If the men are near the cars at noon this man goes in at 11 o'clock and gets the noon meal. The whole gang works overtime to make up for the cook, without charging the extra time to the company, and distributes the extra time of the other two meals among themselves. They also pay for the food in the same manner. We have held the gang together in this way for two years and can depend on the men to work cheerfully in any emergency—overtime, rains, snow or floods without a growl or grouch. This outfit could not get beds in a hotel for the men at less than 50 cts. per night at any point on their territory, and cannot get a laboring man's meal along the line at 35 cts. They board themselves at a cost of 18 to 22 cts. per meal (including the extra cost of the cook at night and morning), and have just what they want to eat of common, wholesome food.

We would also suggest furnishing outfit cars that are warm and comfortable enough to allow changing clothes and drying them in cold, wet weather. These cars should be provided with modern bunk car iron beds with springs, as the car is the home of the men the year round.

If the railroad would provide these two conveniences and even furnish a cook, it would be more than repaid, as the principal objection to the wages paid is the cost of bed and board.

We do not think it necessary to offer the high wages paid by the contractors for experienced help as such work is intermittent, while part of the bridge and building work, if properly handled, can be made continuous and furnish a steady job most of the time. The lost time looking for a job is largely eliminated and the continuous wage at a less figure is more attractive, where living can be had at a minimum, than the lost time at higher wages, caused by the necessity of hunting a new job, and perhaps, paying for transportation to the new job, with the possibility of being unable to suit the new foreman or employer after the new job is found.

FUNDAMENTAL CONSIDERATION IN HOLDING MEN

By E. C. Zinsmeister

Master Carpenter, Baltimore & Ohio, Norwalk, O.

How to secure and hold bridge and building men is a subject of vital importance. Should the war continue, causing continual demand for men for military service, the condition will be of more concern each month throughout the time the conflict continues. The men who at present are being drafted for military service are of the proper age to give good work on bridge and building work problems.

In my opinion, there are four important features necessary to secure and hold men: (1) The scale of wages. (2) Camp facilities. (3) The personality of the foreman. (4) Favors granted by the railroad.

The rate of wages paid is the first subject of inquiry made by a man looking for employment, and, if not sufficiently attractive, the man will look elsewhere for work. In bridge gangs, I would recommend three different rates of pay, and for building work two different rates other than that paid the foreman. This allows the grading of the men and those employed at a lower rate look forward to a place at a higher rate, which I believe is some inducement for them to stay on the work.

The camp facilities are also a very important consideration and should be composed of sanitary, well-ventilated cars.

The personality of the foreman is a very important aid in holding men on the work. The foreman should make a study of the personality of each man in the gang, and thereby learn how to approach him and keep him in a good humor and a willing worker.

Favors granted by the railroad also have influence in holding men in the service, as for instance, the issuing of a card pass with limits based upon a scheduled number of years in the service, with similar privileges for the wife also.

Sunday work should be avoided as much as possible except in cases of emergency. In emergency the feeding of the men and the number of consecutive hours on duty are important factors and should receive due consideration.

FUNDAMENTAL CONSIDERATIONS

By J. S. Lemond

Assistant to Chief Engineer Maintenance of Way and Structures, Southern Ry., Charlotte, N. C.

We should have the best camp cars obtainable for our bridge and carpenter forces when they are to be moved from point to point. The cars should not merely be something to shelter the men, but they should be good, comfortable, conveniently arranged, and neatly kept, well heated and ventilated, and as homelike as is possible to make them, as these cars are the homes, practically speaking, of these men. The pay of these men should be on par with that paid for similar work in

the section where the men are employed and regular employment should be assured them. Good cooks should be furnished by the company whose duty should be to prepare the food in the proper manner for the men and care for the camp cars, keeping them in neat and clean condition at all times.

Where it is practical to operate them, motor cars should be furnished the men, as it is to the interest of the company and the men to do so. The foremen should treat the men humanely, at the same time see that the company is served faithfully by keeping them diligently employed. Those of the men who have families should be accorded the privilege of going to their homes at the end of each week, when the interest of the company does not suffer thereby.

DISCUSSION

The President:—It has always been a mystery to me how railroads can get and hold such good bridge and building men as are working on the roads at the wages that are paid in comparison with wages that are paid for work that can be done by those men in the communities in which they live. I don't know what it can be, unless it is the various little concessions the men get and the regularity of the work. But I think these papers that have been read will give us all something to think about as to the way in which the work can be made a little more desirable to the men.

For example, in going out over bridge inspection trips, I have always made it a point, where I could, to eat in the bridge cars. That one thing gave me a good sidelight on the living conditions of the men. Most generally I found the meals were good, but occasionally I ran into a camp where the eating was very poor, and those outfits generally were short of men; good work could not be done, and all things considered, the work accomplished was on a par with the food that was served. A little more effort and supervision by the supervisor in the right direction would often induce the men to stay.

Another thing I ran across a great deal, and I think it is more necessary to watch it now than ever before, is the privilege of letting the men get away often. I have known men to stay on the jobs, when they are far away from home, for several months at a time, for the reason that in order to get home they would have to leave a half-hour or an hour earlier on Saturday and perhaps get back a little late on Monday morning, and for that reason the foreman, who had a lot of work to do, thought he would hold on to the men in order to get every day of the week in and deny the men the privilege of going home

as often as they might have gone had a little of that time been lost. I think that by losing that little bit of time the foreman would get a great deal more work out of the men by letting them go home oftener.

One other thing that comes to my mind is congeniality. It sometimes happens that one man is a perpetual grouch, and while his services may appear very necessary to get the work done, the gang would be better if he wasn't there.

I have had a lot to do in arbitrating contentions and disputes arising on street railway companies' forces, and I know that the men always insist that where the motorman and the conductor of a car are not congenial, they be changed and put on separate lines. If a man is a perpetual grouch he had better get out.

I think some of the discussion can be applied as well to the next paper, as to this, Housing and Feeding Bridge and Building Maintenance Crews, by F. E. Weise. After Mr. Weise presents his report we will continue the discussion.

Now you men here have had so much more to do with that than I have, that I am sure you can contribute something to the discussion after hearing these papers read, that will be very valuable to the proceedings.

B. F. Pickering:—I was very much interested in those papers and especially in the point brought out by Mr. Wood, regarding our personal reputations. I think that the thoughts brought out in that idea go farther towards securing good men and keeping them than any other factor in the holding of men in boarding car outfits. In the territory which I cover we have a great many boarding car outfits, but we also have quite a number of local forces, for, of course, men don't care to go into a boarding car outfit, where it will cost them approximately $3 a week for food, if they can get into a local crew and be at home. That is quite natural. As a result we have hard work to get men for the boarding car crews.

I have found that not only my own reputation, but the reputation of the foreman the men are going with counts a whole lot. If he is a man who looks after the interests of the men the same as he does those of the company, and considers every man as a man, and not as so much machinery and so many tools, he is very much more likely to get good men and hold them than a man who has a different reputation. I believe that we should

make our outfits as comfortable and homelike and as pleasant to our men as we possibly can, consistent with the expense involved.

I have been trying an experiment recently which has worked out splendidly. During this summer we found the greatest difficulty in securing cooks. We have several cantonments in our territory, and as the army is paying high wages for cooks, quite a number of our best cooks left us. This created a problem; we did not want a drunken cook for he is worse than no cook at all; we did not want a cook who was not neat and clean, for uncleanliness is the next worse nuisance. It got to be a very serious problem with us, and finally I hit on the plan of either selecting some man in the crew or of employing a man who could go in the crew who had a wife who was a good cook, and who had no children, putting the wife into the cook car (a portion of the cook car is partitioned off, making a nice room for the man and his wife to occupy). The wife does the cooking, and the plan is working out fine. Somehow,—I don't know how it is,—but the woman adds a few homelike touches to the car, and it makes the men feel more as though they were at home.

I was struck greatly with that thought just before I came away. I had just started an outfit of that character; perhaps the woman had been in the outfit two weeks, and I hardly knew the camp myself when I got in it. Instead of being merely a bare place for the men to live, sleep and eat in, she had touched up here and there and added a few things, which I couldn't specify, but which made it seem like home. As I went among the crew, and through the car the men were loud in praise of the new cook. They said it was just like being at home, and that counts a great deal in keeping the men.

I think we should allow the men to get home as frequently as possible. In fact, I make it a rule, wherever possible, unless they are to work over the Sabbath, for them to go home Saturday afternoon and return Sunday night or Monday morning, if conditions will permit.

I am democratic enough to believe that a supervisor is none too good a man to speak with his men and allow them to consult with and associate with him, even the humblest man in the ranks. Of course, I have so many of them that I can't remember all their names, but I can remember their faces, and I

believe it does a great deal of good for a man, whether supervisor or foreman (and the higher the position the more good it does), to get around among the men and say, "Hello, Jack; Hello, John—how are you?" Treat them as though you consider them of some consequence in your business, and I think you will get better results.

THE MATERIAL PROBLEM

With Reference to Bridge and Structural Steel

By Albert Reichmann
Division Engineer, American Bridge Company, Chicago

The material problem in reference to bridge and structural steel has been assigned to me for discussion—a task I can assure you to be no small one under present conditions. The breaking out of the European war created great activities in practically all lines of American commerce and industry, in which the natural economic laws of supply and demand governed. Unfortunately the railroads, while enjoying these activities to some extent, could not enjoy the fruits thereof to the full extent and they were, consequently, retarded in their natural development for which we are now suffering. Owing to the prevailing uncertainties of the present situation, it is most difficult to analyze correctly the material situation of today. To convince oneself of the difficulty arising out of the situation, he has only to read the predictions made by eminent political economists and statesmen at the beginning of the great conflict.

As our steel conditions are intimately related to present European conditions, it might be well to give some idea of the approximate maximum annual production of the various steel producing countries which are at present engaged in this war. The production of

Great Britain in 1915 was	8,351,000	gross tons
France in 1913 was	4,635,000	metric tons
Russia in 1914 was	4,817,500	metric tons
Belgium in 1913 was	2,467,000	metric tons
Canada in 1915 was	911,000	gross tons
Italy in 1913 was	933,500	metric tons
or	22,115,000	tons

The production of the Central Powers was:

Germany in 1913,	18,959,000	metric tons
Austria-Hungary in 1915,	2,686,000	metric tons
	21,645,000	tons

There is such a slight difference between metric ton and gross ton that I have not reduced these to the same equivalent.

Owing to the fact that at least two-thirds of the French, and practically all of the Belgium steel-producing facilities are in the hands of the Germans, the available European steel supply of the Allies is reduced to about 16,558,000 tons; whereas the Germans, undoubtedly, get some benefit from the Allies' properties which are under their control. Consequently, a large amount of steel must necessarily be furnished the Allies by this country in order to meet with their requisite supplies for the conduct of the war.

It is frequently said that steel is either "Prince" or "Pauper" in reference to business conditions. It certainly is "Prince" in all activities connected with modern warfare. Present day warfare is so inti-

mately correlated with industry that the nations with a highly intensified industrial development have a decided advantage in the conduct of the war. This is especially true of the steel producing nations.

It is certainly very gratifying that our nation has such wonderful industries at its command. All thinking people must feel truly grateful to those wise statesmen who advocated and enacted the laws which fostered our industrial development.

Prior to the war, the maximum production of steel in the United States was 31,300,000 gross tons in 1913, which, owing to the activities produced by the war, was increased to 42,773,680 gross tons in 1916 (and is being still further increased during the present year), from which it will be noted that in 1916 the United States produced approximately 50 per cent of the entire steel production of the world.

To meet our own requirements of the war, as well as those of the Allies, it was necessary for us to construct large plants, built almost entirely of steel, for the manufacture of everything used in carrying on the war, such as rifles, cannon and ammunition, as well as products pertaining to transportation, such as boats, locomotives, cars, rails, etc.

Whatever the national welfare depends upon should be provided regardless as to whether it pays commercially per se or not. A good national mercantile marine is one of these necessities. I feel quite confident that those statesmen cannot but feel deeply chagrined at their lack of foresight, who, knowing that commerce is the life blood of the nation, either stood in the way of or failed to assist in legislation which was intended to encourage or foster the building of a mercantile marine, which we so sorely need at present. We are now called upon to supply our one great need, namely: ships, which I can assure you will be no small undertaking. According to press reports we are to build 6,000,000 tons of shipping in one year. To give you an idea of the magnitude of this enterprise, I need merely state that the world's production of shipping in 1913 was 3,333,000 tons, of which Great Britain produced about 2,000,000 tons.

The construction of ships will necessitate the building of great ship yards. Thanks to the fact that our producing facilities have been increasing for some time, and furthermore, that many of our industrial plants can be used in conjunction with the shipbuilding plants, the output of this industry can be both hastened and materially increased.

Of the total production of steel in the United States, structural materials consisting of steel bars, shapes and plates constitute about 12,400,000 tons. According to one of our New York leading financial publications, it is expected that the Government will require about 7,400,000 tons, leaving about 5,000,000 tons for other uses.

As all steel producing plants are booked ahead for a very long period and many orders are for material needed in connection with industrial and other purposes which are not essential from a national defense standpoint, the United States Government has established what is known as a "Priority Committee" with Mr. R. S. Lovett acting as chairman.

Through the issuance of so-called priority classes and numbers, rolling mill schedules are arranged so that the material which is needed most urgently by the Government, as well as on Government work, is given preference. This applies not only to work for the Government, but also to other work which is just as urgently required, such as ship building plants, ships, and certain classes of railroad work considered necessary for the national welfare.

The regulations respecting priority which must be observed by all producers of iron and steel, as well as the manufacturers of products thereof, are briefly as follows:

All work shall be divided into three general classes designated as Class A, Class B, and Class C, with various sub-divisions indicated by a suffix number, as Class A-1, Class A-2, Class B-1, Class B-2, etc. All

work in Class A shall take precedence over work in both Class B and Class C and work in Class B shall take precedence over work in Class C, irrespective of the date the orders were received. Work in Class A-1 shall take precedence of work in Class A-2 and work in Class B-1 shall take precedence of Class B-2, etc.

Class A comprises war work, that is to say, work urgently necessary in carrying on the war, such as arms, ammunition, ships, etc., as well as materials required in their manufacture.

Class B comprises work which, while not primarily necessary for carrying on the war, yet is of public necessity and essential to the national welfare.

Class C comprises all work not embraced in Class A or Class B and no certificate of the Priorities committee will be required therefor. However, an order for work or material not accompanied by a certificate to the effect that it falls within Class A or Class B will be treated as an order for work in Class C.

After a careful consideration of the steel problem, both with reference to production and to the apparent government requirements, it would appear that there will be sufficient tonnage remaining for ordinary construction purposes with a reasonable time for deliveries.

DISCUSSION

The President:—Mr. Reichmann stated in his closing statement that with the present production it appeared that, allowing a reasonable time for delivery, there will be plenty of structural steel manufactured. However I still think that whenever you men can avoid the rebuilding of a bridge and adopt some other expedient to cut down the demand for steel at this time, it will ease the situation up in the steel market. No doubt some of you have encountered this problem already and have adopted some other expedients, on account of the high prices or the delay in deliveries.

The Yellow Pine Situation

By Dr. Herman von Schrenk, St. Louis, Mo.

I have been asked to say a few words about the material situation as far as yellow pine in the south is concerned in connection with construction work. While I am usually very much of an optimist along those lines, the story I have to tell about the immediate supply of construction timbers of southern yellow pine is not quite as optimistic as I would like to have it. Most of you know that during the past four or five months the Government has made demands upon the yellow pine industry such as have never been made before. The construction of the large number of cantonments has taken millions and millions of feet of the stocks that were on hand at the mills, and I don't

think it is claiming too much to say that the yellow pine industry has acquitted itself of the national responsibility in a manner which it certainly has every reason to be proud of. Most of the material taken in the cantonment construction was small dimension stock; the large sizes were not so much in demand; but just last week the Government issued an order commandeering practically the entire output of every southern pine mill from Texas to Virginia for all timbers 12 in. by 12 in. of 30 ft. length and larger. You can realize the necessity for such action when you contemplate the present shipbuilding program which the Government has outlined,—260 ships, requiring an average of 1,600,000 ft. of timber per ship. Our facilities for getting out this number of ships and carrying out this program probably will mean continuous operation of the plants for a period of not less than 18 months. In other words, the great bulk of the structural timbers of that size must now be saved for the emergency program.

Sixty of these vessels are building at the present time on the South Atlantic and the Gulf coast. Doubtless a good many of the timbers will also be supplied from the mills of the Pacific coast region, but the supply sent east will be comparatively small. It behooves those who are located in the eastern and central territory to recognize this state of affairs and to bear patiently with the situation.

The question has already been asked me from four or five sources as to what we are going to do about it, in view of the commandeering of the material by the Government. That is not quite as hopeless as it appears at first, because the Government is making every effort to so classify the needs that the legitimate demands of the industry shall not suffer. They have put the matter in charge of a committee which will determine the necessity of the case in each individual instance. When any particular railroad has to have timbers for repairs or new construction work in order to maintain its line, the proper procedure will not be for the purchasing agents to go promiscuously to their former mill friends or the manufacturers who formerly furnished them materials, because that will do them no good. The proper method of procedure will be for that particular railroad to approach the lumber committee of the National Council of Defense in Washington with specifications drawn up for what it needs, or to address the office of the secretary-man-

ager of the Southern Pine Association in New Orleans, who will in all probability transmit that information to the lumber committee of the National Council of Defense. This committee will pass upon the necessities of the individual cases and issue such instructions as will in all probability release the necessary material whenever it is needed.

Nobody can tell how long this will last. There need be no question whatever about the smaller sizes. They are available in abundance, and while the stocks are somewhat depleted at the present time, owing to the slowness with which freight is being moved, there ought to be no difficulty in getting the small stuff in the future just the same as in the past.

The second problem we are all up against—and this applies to all kinds of lumber—is an attempt on the part of those of us who are entrusted with the responsibility for the handling of the materials to change our ways. We must get the maximum service out of the timbers that we already have in structures or on hand for repair work. If we have never practiced conservation in railroad work before, it is now time for us to get busy and study out the best ways and means of doing it.

We have all been more or less reckless in the conservation of our stock and there is not a single day that goes by but that we find stuff which we can make serve purposes that it does not do at the present time. We have been over-fortunate up to this time in having an abundance of material to depend upon, and some of us have gotten to be shiftless in the way in which we have utilized material. But if we all take heart and pull together, we will be able to keep the railroads up and keep the trains running in a state of efficiency which I think the Government has a right to expect of us.

The Douglas Fir Situation

By O. P. M. Goss, Seattle, Washington

I could follow out just about the same line of information as that which Dr. von Schrenk has given you. His explanation practically fits the west coast districts. However, I think that perhaps we have had one trouble out there which Dr. von Schrenk has not had to the same extent, and that is the difficulty with strikes. We felt pretty blue at one time. You must have

heard the news that came back from that section about the I. W. W., and what they were doing. But we didn't give up. We quit everything else and went to work on anything necessary to help keep up the production. I will say that at one time our output was curtailed to about 35 per cent of normal. That certainly looked serious, in view of the fact that we had Government orders for a large number of ships, and we also had orders for a large number of similar ships being built for private concerns. In view of those large orders, all of which had to be hurried to the limit, the strike situation made us pretty blue, but, as I said before, we did not give up; we simply plugged and plugged and finally have worked through it. When I left the coast we had increased the production to about 75 per cent of normal. That production has gone into ships and cantonment materials for various parts of the United States.

We, of course, depend entirely on Douglas fir for what you might term structural timber. About 25 per cent of the standing timber supply in Oregon and Washington is of Douglas fir.

In getting out the spruce, our strike situation developed something new. After collecting the data and finding out where the trouble lay, we uncovered a movement to curtail all logging operations in the spruce camps. When we had satisfied ourselves as to what the situation was, it looked serious, but fortunately the Government came along with the final stroke which I think absolutely broke the back of the I. W. W. Now the spruce camps are all operating again, but not until the Government commandeered practically every mill and logging camp along the coast. The strike condition is getting better from every standpoint all the time, and from now on I can't see why we should have any trouble in getting the material out for the Government or for railroad work.

Now, as to the facilities for getting the lumber here. We have plenty of cars now, although the shortage was serious for a time. We have been able to ship lumber just as fast as it was required and we don't expect any great difficulty in that respect. We are rather proud of our accomplishment in getting material for one cantonment in Wisconsin in just six days. We sent a number of full train loads which came through in that short time. We felt that was a sign of pretty good operating facilities on the part of the railroad, which, in that case, was the Northern Pacific.

Water Service Materials*

Paper by C. R. Knowles
Superintendent Water Service, Illinois Central R. R.

Although a very conservative estimate of the increased cost of all materials used in maintenance of way work has been given as 30 per cent, I think we can safely say that, with few exceptions, this figure will come nearer representing the minimum increase in the cost of water works materials, many items having increased several hundred per cent. The unprecedented prices and the uncertainty of delivery have created conditions which make it very necessary to employ methods that will help to conserve materials used in water works construction and maintenance, especially with such materials as are particularly difficult to secure.

From the present outlook some relief appears in sight as regards prices of certain materials, the price of cast iron pipe having dropped $15.00 per ton on October 1, although with the government and foreign requirements in addition to the greatly increased domestic demands for materials of all kinds we cannot hope for much relief in the near future as far as deliveries are concerned.

While all materials have advanced in cost the increase has been more marked in iron and steel products, and articles manufactured from brass, copper and other semi-precious metals. Boilers have doubled in cost with indefinite dates of delivery on those built to specifications. Steel tanks of all kinds have advanced from 100 to 150 per cent, tank hoops from 75 to 100 per cent, steam pumps from 40 to 50 per cent, and oil engines 30 to 40 per cent with deliveries from 3 to 9 months in the future, depending on the size of the units.

All stocks of steel and wrought iron pipe have been depleted and it is difficult even to get a quotation on a definite date of delivery on large pipe. The following table indicates the approximate prices prevailing on steel and genuine wrought iron pipe from 1914 to date:

	Steel Pipe	G. W. I. Pipe
January, 1914,	$43.00 per ton	$55.00 per ton
July, 1914,	42.00 " "	54.50 " "
January, 1915,	43.00 " "	55.00 " "
July, 1915,	44.00 " "	55.50 " "
January, 1916,	47.00 " "	59.00 " "
July, 1916,	68.00 " "	85.00 " "
January, 1917,	82.40 " "	103.00 " "
July, 1917,	114.40 " "	143.00 " "
October 1, 1917,	114.40 " "	143.00 " "

The above prices apply to base sizes, that is, ¾ in. to 3 in. B. W. steel and ¾ in. to 1½ in. B. W. genuine wrought iron. It is impossible to prepare a table on larger pipe that would indicate even an approximate price as all quotations have been based on delivery and stocks on hand. To illustrate the scarcity of large wrought iron pipe, one of the largest oil well supply houses in the country, has pulled well casing from the ground that has been in use for 19 years and paid the owner of the wells 20 per cent more for the pipe than was paid for it when new, 19 years ago. The pipe was then sold for double its original cost.

Delivery on cast iron pipe has been fairly good, although the price has more than trebled in two years. We are laying cast iron pipe today that ranges in cost from $18.50 to $60 per ton, while the lead used in making the joints has advanced from $3.75 to $11 in two years.

---

*Forming part of the Report—The Material Problem.

The following table shows the range in cost of cast iron pipe from 1912 to date:

Year	1912,	Approximately	$20.65	per net ton
"	1913,	"	20.35	" " "
"	1914,	"	18.50	" " "
"	1915,	"	18.60	" " "
"	1916,	"	25.00	" " "
January	1917,	"	32.75	" " "
July	1917,	"	49.30	" " "
October 1,	1917,	"	60.00	" " "

In justice to the cast iron pipe manufacturers it may be said that the increase in the cost of pipe has been more gradual than the advances in iron. This may be explained by the fact that the cast iron pipe manufacturers had some iron bought ahead and only advanced prices as the old contracts expired.

There are many reasons for the difficulty in securing material and delay to shipments, the chief reason being on account of the enormous amount of material going to foreign fields and taking precedence over orders for materials for domestic use. The shortage of labor and labor troubles have also had a serious effect on the material situation. The labor situation is daily growing more critical and will continue to affect the delivery of material. We cannot look for much if any improvement for the duration of the war.

It is along the line of salvaging old pipe lines that the greatest good may be accomplished in conserving water works materials. The salvage of cast iron pipe is almost 100 per cent. Except for the cost of removal a cast iron line is of as much value when taken out of the ground after years of service as when it was laid. It is true that a year ago with cast iron pipe at $18 per ton the cost of removal would have in many cases almost equaled the cost of new pipe, but with pipe at $60 per ton the removal of old lines is a paying proposition. In many instances wrought iron pipe may also be salvaged to good advantage. For example 600 feet of 5-inch genuine wrought iron pipe laid at Hampton, Miss., on the Yazoo & Mississippi Valley was recently removed at a cost of less than 10 per cent of the value of the pipe. This pipe was in excellent condition notwithstanding the fact that it was laid 30 years ago.

The saving effected by the conservation and salvage of second hand material is not confined to pipe alone but includes all classes of materials. Tank hoops may be repaired and used on other tanks. Sound staves and bottom plank may be utilized in the construction of smaller tubs; valves and fittings may be repaired at a small cost and made to answer for new. Rubber pump valves may be faced off and used again; pump packing worn too small for one pump may be used in a pump requiring smaller packing. In fact with present price conditions there are but few items that will not justify the spending of considerable time and effort in their conservation.

In many cases standards may be revised, substituting material expensive and difficult to secure with that less expensive and more easily obtained. For example, we have changed the design of our water column pit, eliminating about 3,000 lbs. of castings and several hundred pounds of reinforcing bars and I believe we now have a better designed pit than we had before. The difficulty in securing steel plates and the great increase in cost of steel tanks have forced many railroads which had practically adopted the steel tank as a standard to return to wood. The high price of steel has also stimulated the interest in concrete tanks and there is great activity along this line. The high cost of cast and wrought iron pipe has caused many roads to give serious consideration to substituting wood stave pipe for iron pipe.

A great deal may be accomplished in conserving materials by overhauling scrap piles and reclaiming second hand material, also by cleaning out shelves, boards and the pump houses of the ever-present accumulation of globe valves, fittings, etc., held for a fancied emergency that never occurs. Scrap has advanced in price to such an extent that in some instances the scrap value of an article is in excess of its cost new a few years ago, consequently scrap should be kept cleaned up and forwarded promptly to the storehouse in order that it may be disposed of to the best advantage.

It has been truly said that, "The ways in which material and supplies are wasted on a railroad are as many as the number of persons in its employ," and if we may learn the lesson of economy in the use of materials from the present situation it will not have been without its good effect.

DISCUSSION

C. R. Knowles:—Although a very conservative estimate of the increased cost of materials entering into the maintenance of water works, has been given as 30 per cent, I think we can safely say, with few exceptions, that this figure will come nearer representing the minimum as regards water service materials, many items having increased several hundred per cent.

The prices for steel products recently set by the Government will not be available for the general public, on account of the demands of the United States and the Allies overtaxing the capacity of the mills. However, it has tended already to lower the market price and will put steel products within the reach of the railroads' purchasing power. Heretofore, it has not been a question of whether you wanted to pay the price for it, but you couldn't get the material at any price. Today you can not get wrought iron pipe larger than 6 in. in diameter at any price.

The President:—You have heard the papers on the present bridge and building material situation as to structural steel, timber and water service materials. One thought occurs to me, and that is that if the demands of the Government are going to continue for some time it will make tremendous inroads on the steel production. The demands of the Government caused a heavy demand for timber for the cantonments, which made it very difficult to get anything while the cantonment construction was going on, but I am inclined to think that the situation was practically temporary, because they are completed now. We have also heard of the water service situation. As steel and timber were very hard to get, I think that that condition will cause us in many cases to turn to other materials. I think that concrete materials—being,

as they are, local in character—will be used more and more. Cement can be made all over the country, and sand and gravel can be obtained locally in most cases. Steel can be eliminated in many cases by substituting concrete.

I. L. Simmons:—We (on the Rock Island) are in rather a fortunate position this year, owing to the fact that we ordered our bridge steel about two years ago. We have all we can put in, so the material situation has not bothered us very much from the bridge standpoint. Of course, next year we may be cramped so far as structural steel is concerned, but the use of concrete on our road has cut down the amount of steel which we require. I believe that is going to be the solution of our problems, using concrete trestles and concrete boxes, and possibly going to concrete pipe where we have been using cast iron pipe.

I think the railroads will have to adjust their standards to the new condition of affairs. Some roads have not believed in concrete, but the new conditions have brought about the fact that, whether they believe in it or not, they have got to try it out. Once they have tried it out, there is no question in my mind but what they will stick to it.

We probably will not be in the market for very much bridge steel next year. We have taken out a lot of structures to prepare for heavier loading, and in the last four years we have scrapped very few. Our supply of second hand material is very large at the present time, but we are using it up by doubling up the girders wherever possible and changing old girders into new deck plate girders.

J. J. Taylor:—We are having all kinds of trouble to get material on the Kansas City Southern. I think that the solution is going to be resorting to concrete construction. On account of heavier loading we have had to take out several of our larger spans. We have not been able to dispose of them because they are not heavy enough for use elsewhere.

R. C. Young:—There is one way of conserving steel production and that is by the use of the oxy-acetylene welding apparatus whereby you can weld new gears on castings, take old bridge trestles and cut the columns up into shorter lengths, put new feet on them and use them in other structures instead of scrapping them. I had an experience in taking down a very high trestle which was too light. I came very nearly selling the material to the scrap-iron men at a very low price, but finally I

found out about the new apparatus at the last moment and I have built several smaller trestles of that very material which I intended selling to the scrap-iron men for almost nothing.

H. Gerst:—On the Great Northern all of our structural timber, such as bridge ties, comes from the coast. We use Douglas fir, and we figure all the way from three to six or seven months for the time of delivery. The market has been pretty badly demoralized the last few months, and it is hard to tell just what deliveries we can get. We get some cedar from Idaho, but that is nearly all piling. Practically all of our lumber is Douglas fir.

J. M. Staten:—Three or four years ago we had to take out a lot of light girders on account of heavy traffic, and we didn't dispose of them for scrap right away. In the last two years I think I have put in 40 or 50 spans from the stringers by putting two to the rail and using wooden braces. The structure was built for 50 ft. spans (about eight or nine of them) but we built wooden towers in the middle and put in 25 ft. stringers and the wooden braces. This makes a queer bridge but it closed up the waterway all right.

We have over 100 spans right now that we have not been able to buy steel for and we have been putting in temporary stringers and wooden braces. We have about 9 or 10 spans trussed up now, but we are trying to make them run until steel gets down where we can buy it.

The President:—There is one thing on which Mr. Simmons dwelt for a short time, and on which I have always been a crank—even when steel was cheaper and more easily available than it is now, and that is—using old spans back in the track again. In my practice I have not only installed deck plate girders again by doubling them up, but I have followed very largely the practice of shortening up truss spans and also cutting down to single-track, light, double-track spans that have been taken out. Generally, when a span is taken out, there are some particular members which are weak, and those members, if the truss could be taken down, dismantled and put together again, could be reinforced and the truss would have a carrying capacity until a very material further increase in loads should take place. It is frequently possible by cutting down the truss span (sometimes a couple of panels) to install it in the track again.

Just recently I finished a bridge across the Trinity river at Dallas where a 200 ft. span was cut down to 162 ft. Two panels were taken out of it, but the same chords, bars and the compression members were used. The work was all done in the railroad shops. When the bridge was taken down I think it had a capacity of E-35 and it went back as E-60. When it was taken out it would not carry an engine weighing 80 tons on the drivers, but when it was put back it was rated for an engine carrying 150 tons on the drivers. The cost of shortening it was only about one-quarter of the cost of a new bridge.

I had another case of a double-track span being taken out at St. Louis. The spans were given a new floor system of single-track strength and no change whatever was made in the trusses and they now rate considerably over E-60.

In the material yard of almost every railroad, up to the time that scrap got so high, could be found any number of old trusses for which the purchasing agent was trying to find a purchaser who would give from a cent to a cent and one-half a pound, and a lot of it is gone, I presume, because I have seen a lot of railroad yards which have been depleted, but those old spans could have been reinforced and remodeled at a very small percentage of the cost of a new span and put back in service. There is more reason now for that than ever before. The bridges that are being taken out now are built of good material, and they can be reinforced and changed slightly and put back with a very substantial increase in capacity.

Sometimes we find some of the diagonal members are weak and the bridge is not good. If it is taken down and shipped to one of the machine shops on the railroad and worked over a little, it can be put back and it will have a capacity of from 20 to 25 per cent in excess of its capacity when it was taken down.

L. Jutton:—I recall several cases on the Northwestern where we have worked spans over without taking them out. They were reinforced and the weaker members were strengthened by adding additional members. The work was done at a very low cost and the capacity of those bridges was changed from something like E-40 to better than E-60.

W. M. Camp:—It probably is not saying anything new, but it has even been practical to add extra flange plates to the tops and bottoms of girders for a good many years, to make them stronger.

I. L. Simmons:—There is one point which has not been brought out. Take the old lattice spans built from 1888 to 1892; probably they will not rate higher than E-42 or E-43, while a good main line bridge should rate about 55 or 60 now. If you examine those spans you will see that the direct stress will probably be taken care of all right, with the exception of the rivets. In one case I have in mind on our main line we went over all the connections, knocked out the ¾-in. rivets and put in ⅞-in. redriven. We did this at a very moderate cost and we have a bridge now over which I am perfectly safe in putting an engine weighing up to E-55 or E-56, and I do it with no hesitancy whatever.

I think that at this time, before we consider taking out a bridge or a span at all, the first thing to do is to consider what we can do with it to keep it in. In looking over your rating chart, you may find a bridge rating about an E-42 and you say, "That has to come out," but get your diagram and see what parts of it are weak, and you may be surprised at the amount of good you can do that structure at a cost of from $400 to $600. I believe it is up to every one to see what can be done to carry over structures before figuring on putting in new ones.

W. E. Alexander:—The International bridge on the Main Central at Vanceboro was first erected as a pin-connected bridge in 1888. After a while they found that it was not heavy enough for the loads they wanted to put on it. The way they strengthened that was to make duplicate trusses, placing them on the outside of the original trusses.

The President:—I will say that each particular steel bridge is a study in itself, and it is not an easy job for a bridge man to sit down with the plans of an old light span before him and say what ought to be done to that particular bridge to get it in shape. There is no doubt there are cases where duplicate trusses can be put in and connected up to work together. But it may be a question as to whether the expense required in that connection would be justified.

Old bridge spans were built for certain types of engines. If the old engines and cars had increased in the same proportion in length as to weight, and if every member in the bridge had been designed exactly right in the first place, every part of the bridge would reach its maximum strength at the same time. But we often find in a bridge that perhaps 5 out of 25 members would

be stressed up to the limit of safety and the others might have many points of strength left in them. It is impossible to give a general answer as to whether duplicate trusses can be put in beside the others and make it a practical, as well as an economical proposition.

Now to get off of steel bridges and come to trestles. Down in the southwest they are very prodigal of timber, and they do it because it comes to them easy. They go in and drive piles because some of them are rotting off at the ground line. This is one of the worst wastes of material that I know of. There are so many ways in which that material can be conserved and saved. Let us consider a pile 40 ft. long that is half out and half below the ground. There is a section of about 4 ft. right in the center of that pile that must be thrown away, but the other 18 ft. below and the 18 ft. above the ground are still pretty nearly as good as when placed in service. We should find out how best to protect those piles at the ground line. There are many bridges built up to 10 years ago that can still be protected by some sort of a preservative coating. Boxes of salt might be put around them at the ground line, or they might be sunk into the ground a little.

Those are the stunts I think it is particularly valuable to follow at the present time. If some of you gentlemen who know so much more about it than I do will get up and tell about them it will be a valuable aid to us all.

H. von Schrenk:—It might be of interest to know of something I personally tried on half a dozen bridges with salt boxes. We had several trestles down in Louisiana built of rather sappy pine piling. We did not have the money to put in new ones just then, and those that were in looked as if they should serve for a time, so we had some shallow boxes built immediately. The boxes extended out from the piles possibly 4 or 5 in., care being taken so that the bottom of the box did not fit too closely around the pile. Then we ran a handcar full of rock salt over the bridge and simply shoveled the boxes full. Every time it rained some of the salt would dissolve and run down beside the pile and stick there, finally drying and turning hard, so that after three or four rains the piles were practically like alabaster. We thought the ordinary length of time those piles would last could not be more than five or six years, but they are just as hard as stone today after 5 years' service. I don't remember the exact cost, but

it was so small as to be almost insignificant. This last year I have been planning to put the same kind of work on some old trestles, which show decay, and I think we can make the piles last several years longer. Those piles are five years old at this time, and we probably would have had to replace them twice over if we had not adopted this expedient.

INTELLIGENT RECLAMATION OF MATERIAL

By C. A. Lichty, Chicago & Northwestern Railway

The best materials are used in the construction and maintenance of railway bridges and buildings. Every employee of the bridge and building department should exercise his best judgment in the intelligent reclamation of the various materials used in his department. Good second-hand bridge timbers were often disposed of in by-gone days in a reckless manner. They were commonly used for backwalls in pile bridges, retaining walls, foundations, platforms, culverts, runways, sidewalks, etc., while pile heads and second-hand piling were in many cases burned, cast aside or given away. Many roads have in recent years built small mills which are equipped with inserted tooth saws for resawing and working up old bridge timbers into all kinds of good usable material. Old stringers with decayed ends have been worked up into lumber entirely fit for interior finish; new elm and maple pile heads can be sawed and turned into jack and cant hook handles; oak heads can be sawed into car stakes, ballast stakes, etc., while cedar heads can be sawed into shingles, as good as any wooden shingle on the market.

The saw mill is not only useful for the working up of second-hand material, but it is very convenient for resawing all of the odd-sized lumber that is left over from the construction of buildings. Every material yard accumulates more or less new lumber of odd sizes, awaiting its turn perhaps for years before it can be used to advantage, while with the use of the small mill it can at once be converted into sizes that are suitable for immediate use. Old buildings replaced with new structures, if not used elsewhere, should be torn down and all of the good material used for repairs or wherever it will work in to the best advantage.

Iron bridges can in many cases be rebuilt or reinforced and put into shape to be placed back in the main line or at least on some of the branch lines of a railroad where they will be of service for many years more. Those too light for railway traffic may be used for overhead highway bridges, etc.

Care should be exercised to see that the reclamation of old materials is not carried to the extreme or going beyond the economical limit. Many roads insist on the practice of keeping materials well picked up and properly taken care of, and in going to a reasonable limit in re-using good second-hand material wherever practical. There can be no question but that the reclamation of material can be made to pay large returns if properly handled and more than ordinary attention should be paid to this item during the present time when it is not only difficult to get new material but more difficult to get it over the road.

Most of the railroads are going into the reclamation of material on a large scale. While the locksmith, the blacksmith and others have—in a sense—been engaged in the reclamation of tools and materials on a small scale for a long time, the roads are now going into it to the extent of erecting separate shops for the purpose—equipped with special machinery, thereby working over at a small cost material which takes the place of new but which formerly may have gone into the scrap pile.

DISCUSSION

The Secretary:—Some of the railroad journals have published a considerable amount of information during the past year on the reclamation of materials, and a good paper might well be made up from those articles. The Railway Maintenance published quite a number of articles on that subject within the past 10 or 12 months.

I have made a study of the reclamation of materials on the Chicago & Northwestern and I am positive that we can make it pay. We have a mill at Boone, Ia., where we saw up hundreds of carloads of good second-hand material into lumber of every description, from track shims and slope stakes up to the heaviest timbers used in buildings. During the past year we built a large elevator where long leaf yellow pine piles were used for the foundation. On account of difficult driving many of the pile heads ran in lengths varying from 6 to 15 ft. We had several carloads of this material and with the sawmill not far distant, we promptly sawed these heads into the best kind of lumber, and it was all utilized. I have seen the time when all or most of this class of material went to waste because we had no convenient method of working it up.

Mr. Knowles, in his paper, tells us how to reclaim materials in the water supply department. The water supply men are always using and re-using second-hand material; we all know how difficult it is to get material in their line, and what it costs when we are able to get it.

One of our members (E. R. Lewis, D. S. S. & A. R. R.) had an article in the Maintenance Engineer several months ago where he took exception to the attempts to conserve old material without considerable study of the question. He thought it inadvisable to try to reclaim some of the old material, saying it would cost more to handle it and put it into use than it was worth. This is true in some cases, no doubt, but I will cite an instance of an experinece I once had on the Northwestern. I was engaged in having scrap and usable material of all kinds gathered up, assorted and sent in (if not suitable for use in the same locality). Upon calling the attention of the division superintendent to the condition of things after a partial pick-up had been made he said, " I believe it does not pay to bother with such stuff; far better leave it alone and let the men work at

something else,—but you go ahead and after one hour's work let me know what is a fair estimate of the value of the material picked up." The material was picked up, much of it only scrap, but a great deal was as good as new. A fair estimate showed the value to be between $60 and $70. The superintendent decided that it would be a good plan to have a general clean-up made and it resulted in a number of carloads of material of all kinds valued at thousands of dollars. Of course pick-ups of such magnitude might not occur now, for we keep after such material all the time,—and it pays to do it.

Mr. Howson is pretty well versed in this matter and I believe he can say a few words to us on this subject that would be interesting.

E. T. Howson:—I am sure that there is no man here who does not realize the importance of reclaiming materials under present conditions. It is not alone a question of economy, but in many cases it is one of providing ourselves with materials through that source when they are not available otherwise.

The reference made by Mr. Lichty to the point originally raised by Mr. Lewis, touches a subject which I think is a most vital one. It don't pay to spend $2 to save $1 worth of material. Yet, under present conditions we should be careful not to use the old estimates. Material that was worth a dollar a year ago is very probably worth two or three dollars now. We have practically got to revise all of our estimates to know just where we stand with reference to the economical limits to which we can go.

Dr. von Schrenk spoke a few moments ago of the wasteful habits that have grown up, particularly in the use of timber, but also in the use of other materials, owing to their availability. It is only in the last five or six years that the railways have begun to take notice of the scrap pile, and those that have been foremost in going through their scrap piles have made tremendous savings. There is a danger of overdoing it, but in nine cases out of ten, the loss at present is not from overdoing it but from neglecting it. Under present conditions the scrap pile offers large opportunities for culling over in order to get the materials to tide us over. Mr. Simmons and others have spoken of that. I think they have given instances that do not need any other amplification. Mr. Knowles' experience of digging up the water pipe is another instance.

When you go to look for materials it is really surprising what you will find. I recall an instance where the general manager of a western railroad started out to check up his track materials a few years ago. He personally looked around the property and at one point he found 155 kegs of track spikes under a section foreman's tool house. When they had finished laying rails the year before the foreman had grabbed the spikes and thrown them under there to get them out of the way.

G. W. Andrews:—For the last 15 years we have been studying the question of the conservation of material, and this subject has grown more extensive each year. As probably most of you know, our president, Mr. Willard, has been taking an exceptionally active part in the National Council of Defense at Washington and he has been preaching conservation to us to such an extent that sometimes we feel that our names begin with a C. We have made, and are making, studies of conservation in almost every line of materials in which railroads have to deal, and if you will bear with me just a few moments, I will endeavor to tell you some of the important things we have worked on.

Within the last six or seven years we have been required to renew many of our structures on the main line territory to provide for heavier power which has grown so rapidly that the bridges became entirely too light; we had to strengthen them at every conceivable point to take care of the weak members, and it was found necessary to renew many of them with heavier and more modern structures.

In the beginning many of the structures were scrapped, but it was finally decided that no girder spans should be scrapped and that the truss spans should be kept as well. Within the last five years we have built a number of new lines in the coal territory in which every bridge entering into the construction of the new lines has been made of structures that were taken out of main line territory, strengthened and shortened. In some instances double track through spans have been reduced to single track spans, or double track through girders reduced to single track girders, or the floor systems taken out and deck girders made of them. In all cases this work has been done at a price far below the purchase price of new structures at that time. When we found some of the girders which were entirely too light even for branch line territory, and where it was not advisable to double them up, we scrapped them, but we have now

discontinued that, and we are now cutting them up with the oxy-acetylene torch and reclaiming every part that it is possible to use again for any purpose whatever. We have our own bridge shop which enables us to do this work with a great deal of facility and in considerably less time than we could have done elsewhere. In these shops we build bridges of a type that it would be almost impossible to get the contracting bridge companies to consider. We do not throw away frogs under any circumstances. They go to our maintenance shops at Martinsburg, where they are cut up and every part that is fit for use enters into the construction of new frogs. We are turning out now close to 500 frogs a month, most of them having parts of the old frogs in them. It is the same with the switches. We reduce the long switch point to a shorter length. Very often the switch is good for the entire length, but the point is snubbed off, so that is cut down to a shorter length.

Formerly we burned all of our old wooden cars, but that practice has been discontinued. We have put in a reclaiming plant at Zanesville, where most of the wooden cars are dismantled, or the old material is sent to Zanesville where it is sawed up in the right sizes to use in building construction for cars. The rods are sent to the system shop in Baltimore and rerolled. We don't use any of these reclaimed rods in bridge work, but we do use them for bolts of every character. Only last week I was in the reclaiming mill and I found that they had, at that time, something like 50 tons of reclaimed rods that formerly went into scrap iron.

Until a very few years ago it was the custom of our divisions to scrap the old pumps. The repair shop would decide it could not do anything with them and they would go into the scrap heap. We took the matter in hand and had the pumps shipped to our Martinsburg shops, since which time (about 5 years), we have not purchased a new steam pump.

We have scrap yards located at Baltimore, Glenwood and Pittsburgh, where all material is first separated and assorted, and every dollar's worth of material that is of value is collected and sent to one of the reclaiming shops where it is put in shape for future use. We feel that in doing this we are not only conserving material, but that we are saving money, even based on the material, at former prices. At the present abnormal prices we are making a fortune for the company every day.

In pipe work we have found a number of cases similar to those Mr. Knowles has described, and in every case that I can recall every piece of pipe of value was reclaimed and used in some other point. We have practically eliminated the use of cast iron pipe for drainage sewers or culverts, and have substituted concrete pipe, which we make of our own design. We are making three sizes, 24 in. 36 in. and 48 in., and we make it for just about one-half the cost if we purchased it.

Some years ago we were purchasing a 50,000 gal. water tank with cypress staves for about $275. To-day it costs $850. We have used methods to save the old tanks to the last moment. We have saved many tanks that in 1902 were declared to be absolutely unfit for service and they are still in service. We simply put in from 4 to 6 in. of fine concrete, made in the proportions of one, three and five, the stone being not more than 1½ in. in diameter wherever possible. I say stone, because we get that from our quarry, but where it is not economical to ship from the quarries we do use gravel. The concrete is placed and then we place two or three additional hoops around the bottom of the tanks. In cases where decay or holes have developed in the staves above that point we clamp a piece of two or three-inch timber, well saturated with coal tar, on the inside. Where the decay is so great we have even put struts across the tank to hold the clamps in place. In many cases where the decay is small we simply put it in with the wood clamp.

We are showing a constant increase in economy in our methods, and, while we think we have this work well in hand, we have not stopped. We are going further in every line. We are at this moment installing a saw in the reclaiming yard at Baltimore, where old bridge ties, stringers, and bridge timbers of all kinds will be sent and sawed up into planks or scantlings. As most of us know, the first decay in a stringer shows at the end resting on the caps. Very often a length of 10 or 12 ft. of the center of the stringer is good. Sometimes it is decayed on top, but if it is a 16-in. stringer there will often be 12-in. of good timber from the bottom up, exclusive of the ends. We expect that the saving in the sawing of that material will almost meet our demand for material for small buildings, etc.

Mr. Brantner:—Mr. Andrews has not yet referred to the actual results and costs. I will state that on all turntables, bridge

girders, etc., a credit of $22 a ton is allowed to the division from which they come. This enters into the first cost of remanufacturing or remodeling the bridge-girders or turntables. The application of the new material and the labor on the bridges we are turning out are costing from 1½ to 2½ cents.

I will refer to a turntable condemned in 1910 as being unfit for service, which Mr. Andrews inspected and decided could be remodeled. It was sent to our shop where we removed the corroded angles and the cover plates and cut out the bad rivets, put in new material, reinforced it in certain spots, put in additional angles and put the turntable back into service in April, 1911, at a cost of $700. That turntable is still in service to-day, turning the largest engines.

Mr. Markley:—I would like to inquire what the original length of that turntable was.

Answer: Seventy feet.

The President:—I would like to speak of some turntables which I have extended on the Texas & Pacific. In one instance a longer table was needed where a 60-ft. table was in, and in another instance a 75-ft. table had to be lengthened. In the case of the 75-ft. table a longer table had to be put in to turn the new engines, so the old 75-ft. table was taken out and extended to 85 ft. and put back again. The wheels were left in the same place and the circle in the same radius, and that table has been in nearly a year now and is doing the work all right.

On the Missouri Pacific I extended a good many of those tables and they are all in use to-day. The cost of extending them is very nominal and a very great saving can be effected by extending 60 and 75-ft. turntables. And you have the additional advantage that they fit the old centers, and you can sometimes extend them in the same pits; you can just extend the circle and put the table right back in the place of the shorter one.

Mr. Andrews mentioned bridge stringers. I think a number of you gentlemen will take issue with me that the best place for a bridge stringer which costs a small fortune now-a-days is under the ties and not to be put down for a dump plank or to make a footing here and there; nothing breaks my heart more than to see a good bridge stringer cut down and put in as a dump plank, when perhaps only two or three per cent of that stringer had served its usefulness. And it would pay better

to make concrete blocks of the same size to be used as footing blocks than to use a costly bridge stringer.

It occurs to me that the life of the stringers in the first place can be extended by perhaps dropping salt down where the stringers join the cap and help preserve it that way, and after the stringers do have to come out there are a lot of better things to use them for than dump planks. It is better in many cases to buy new material for dump planks than to use the stringers that come out.

J. P. Wood:—On all of our new work at the present time on which we use plain timber, where the stringers come together at the ends, where they rest on the caps and where the caps rest upon the piling, we are painting them with creosote oil as a precaution against decay.

The President:—Mr. Ettinger, will you tell us something about the present situation as to paint and oils?

C. Ettinger:—While it may sound queer, it is a fact that the paint market is not suffering to-day to the extent that the rest of the markets in the supplies necessary to carry on the railroad business are. Paint has only increased in price from 8 to perhaps 14 per cent, with the exception of some very high-class articles, and they can be left alone at this time. Our greatest trouble now is with labor. Most of the floating gangs doing painting work, high stage work, and the like, require young, active men. Nearly all of them are within the draft ages.

One difficulty at the outset of the war was the securing of durable colors needed for targets, etc., but the chemists of this country are fast getting up to the point now where they can equal the fellow on the other side of the ocean.

Note: This Association received the title—American Railway Bridge and Building Association—at the 18th annual convention at Washington, D. C., October, 1908. Prior to that time it was called —Association of Railway Superintendents of Bridges and Buildings

LIST OF ANNUAL CONVENTIONS.

No.	Place.	Date.	Membership.
1	St. Louis, Mo.,	Sept. 25, 1891	60
2	Cincinnati, Ohio,	Oct. 18-19, 1892	112
3	Philadelphia, Pa.,	Oct. 17-19, 1893	128
4	Kansas City, Mo.,	Oct. 16-18, 1894	115
5	New Orleans, La.,	Oct. 15-16, 1895	122
6	Chicago, Ill.,	Oct. 20-22, 1896	140
7	Denver, Colo.,	Oct. 19-21, 1897	127
8	Richmond, Va.,	Oct. 18-19, 1898	148
9	Detroit, Mich.,	Oct. 17-18, 1899	148
10	St. Louis, Mo.,	Oct. 16-18, 1900	143
11	Atlanta, Ga.,	Oct. 15-17, 1901	171
12	Minneapolis, Minn.,	Oct. 21-23, 1902	195
13	Quebec, Canada,	Oct. 20-22, 1903	223
14	Chicago, Ill.,	Oct. 18-20, 1904	293
15	Pittsburg, Pa.,	Oct. 17-19, 1905	313
16	Boston, Mass.,	Oct. 16-18, 1906	340
17	Milwaukee, Wis.,	Oct. 15-17, 1907	341
18	Washington, D. C.,	Oct. 20-22, 1908	368
19	Jacksonville, Fla.,	Oct. 19-21, 1909	393
20	Denver, Colo.,	Oct. 18-20, 1910	428
21	St. Louis, Mo.,	Oct. 17-19, 1911	499
22	Baltimore, Md.,	Oct. 15-17, 1912	524
23	Montreal, Que.,	Oct. 21-23, 1913	570
24	Los Angeles, Cal.,	Oct. 20-22, 1914	586
25	Detroit, Mich.,	Oct. 19-21, 1915	665
26	New Orleans, La.,	Oct. 17-19, 1916	710
27	Chicago, Ill.,	Oct. 16-18, 1917	704

	1891-2.	1892-3.	1893-4.	1894-5.
President	O. J. Travis	H. M. Hall	J. E. Wallace	Geo. W. Andrews
1st. V.-Pres.	H. M. Hall	J. E. Wallace	Geo. W. Andrews	W. A. McGonagle
2nd. V.-Pres.	J. B. Mitchell	G. W. Hinman	W. A. McGonagle	L. K. Spafford
3rd. V.-Pres.	James Stannard	N. W. Thompson	L. K. Spafford	James Stannard
4th. V.-Pres.	G. W. Hinman	C. E. Fuller	E. D. Hines	Walter G. Berg
Secretary	C. W. Gooch	S. F. Patterson	S. F. Patterson	S. F. Patterson
Treasurer	George M. Reid	George M. Reid	George M. Reid	George M. Reid
Executive Members	W. R. Damon	G. W. Andrews	Q. McNab	James Stannard
	G. W. Markley	J. M. Staten	A. S. Markley	James H. Travis
	W. A. McGonagle	J. M. Caldwell	Floyd Ingram	J. H. Cummin
	G. W. McGehee	Q. McNab	James Stannard	R. M. Peck
	G. W. Turner	Floyd Ingram	James H. Travis	J. L. White
	J. E. Wallace	A. S. Markley	J. H. Cummin	A. Shane

	1895-6.	1896-7.	1897-8.	1898-9.
President	W. A. McGonagle	James Stannard	Walter G. Berg	J. H. Cummin
1st. V.-Pres.	L. K. Spafford	Walter G. Berg	J. H. Cummin	A. S. Markley
2nd. V.-Pres.	James Stannard	J. H. Cummin	A. S. Markley	C. C. Mallard
3rd. V.-Pres.	Walter G. Berg	A. S. Markley	G. W. Hinman	W. A. Rogers
4th. V.-Pres.	J. H. Cummin	R. M. Peck	C. C. Mallard	J. M. Staten
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson
Treasurer	George M. Reid	N. W. Thompson	N. W. Thompson	N. W. Thompson
Executive Members	R. M. Peck	W. O. Eggleston	G. J. Bishop	Wm. S. Danes
	J. L. White	W. M. Noon	C. P. Austin	J. H. Markley
	A. Shane	J. M. Staten	M. Riney	W. O. Eggleston
	A. S. Markley	G. J. Bishop	Wm. S. Danes	R. L. Heflin
	W. M. Noon	C. P. Austin	J. H. Markley	F. W. Tanner
	J. M. Staten	M. Riney	W. O. Eggleston	A. Zimmerman

	1899-1900.	1900-1901.	1901-1902.	1902-1903.
President	Aaron S. Markley	W. A. Rogers	W. S. Danes	B. F. Pickering
1st. V.-Pres.	W. A. Rogers	W. S. Danes	B. F. Pickering	C. C. Mallard
2nd. V.-Pres.	J. M. Staten	B. F. Pickering	A. Shane	A. Shane
3rd. V.-Pres.	Wm. S. Danes	A. Shane	A. Zimmerman	A. Zimmerman
4th. V.-Pres.	B. F. Pickering	A. Zimmerman	C. C. Mallard	A. Montzheimer
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson
Treasurer	N. W. Thompson	N. W. Thompson	N. W. Thompson	N. W. Thompson
Executive Members	T. M. Strain	T. M. Strain	A. Montzheimer	W. E. Smith
	R. L. Heflin	H. D. Cleaveland	W. E. Smith	A. W. Merrick
	F. W. Tanner	F. W. Tanner	A. W. Merrick	C. P. Austin
	A. Zimmerman	A. Montzheimer	C. P. Austin	C. A. Lichty
	H. D. Cleaveland	W. E. Smith	C. A. Lichty	W. O. Eggleston
	A. Montzheimer	A. W. Merrick	W. O. Eggleston	J. H. Markley

	1903-1904.	1904-1905.	1905-1906.	1906-1907.
President	A. Montzheimer	C. A. Lichty	J. B. Sheldon	J. H. Markley
1st. V.-Pres.	A. Shane	J. B. Sheldon	J. H. Markley	R. H. Reid
2nd. V.-Pres.	C. A. Lichty	J. H. Markley	R. H. Reid	J. P. Canty
3rd. V.-Pres.	J. B. Sheldon	R. H. Reid	R. C. Sattley	H. Rettinghouse
4th. V.-Pres.	J. H. Markley	R. C. Sattley	J. P. Canty	F. E. Schall
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson
Treasurer	C. P. Austin	C. P. Austin	C. P. Austin	C. P. Austin
Executive Members	R. H. Reid	W. O. Eggleston	H. Rettinghouse	W. O. Eggleston
	W. O. Eggleston	A. E. Killam	A. E. Killam	A. E. Killam
	A. E. Killam	H. Rettinghouse	J. S. Lemond	J. S. Lemond
	R. C. Sattley	J. S. Lemond	C. W. Richey	C. W. Richey
	H. Rettinghouse	W. H. Finley	H. H. Eggleston	H. H. Eggleston
	J. S. Lemond	C. W. Richey	F. E. Schall	R. J. Sweatt

	1907-1908.	1908-1909.	1909-1910.	1910-1911.
President	R. H. Reid	J. P. Canty	J. S. Lemond	H. Rettinghouse
1st. V.-Pres.	J. P. Canty	H. Rettinghouse	H. Rettinghouse	F. E. Schall
2nd. V.-Pres.	H. Rettinghouse	F. E. Schall	F. E. Schall	A. E. Killam
3rd. V.-Pres.	F. E. Schall	J. S. Lemond	A. E. Killam	J. N. Penwell
4th. V.-Pres.	W. O. Eggleston	A. E. Killam	J. N. Penwell	L. D. Hadwen
Secretary	S. F. Patterson	S. F. Patterson	C. A. Lichty	C. A. Lichty
Treasurer	C. P. Austin	C. P. Austin	J. P. Canty	J. P. Canty
Executive Members	A. E. Killam	J. N. Penwell	W. Beahan	T. J. Fullem
	J. S Lemond	Willard Beahan	F. B. Scheetz	G. Aldrich
	C. W. Richey	F. B. Scheetz	L. D. Hadwen	P. Swenson
	T. S. Leake	W. H. Finley	T. J. Fullem	G W. Rear
	W. H. Finley	L. D. Hadwen	G. Aldrich	W. O. Eggleston
	J. N. Penwell	T. J. Fullem	P. Swenson	W. F. Steffens

	1911-1912.	1912-1913.	1913-1914.	1914-1915.
President	F. E. Schall	A. E. Killam	J. N. Penwell	L. D. Hadwen
1st. V.-Pres.	A. E. Killam	J. N. Penwell	L. D. Hadwen	G. Aldrich
2nd. V.-Pres.	J. N. Penwell	L. D. Hadwen	G. Aldrich	G. W. Rear
3rd. V.-Pres.	L. D. Hadwen	T. J. Fullem	G. W. Rear	C. E. Smith
4th. V.-Pres.	T. J. Fullem	G. Aldrich	C. E. Smith	E. B. Ashby
Secretary	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Treasurer	J. P. Canty	J. P. Canty	J. P. Canty	F. E. Weise
Executive Members	G. Aldrich	G. W. Rear	W. F. Steffens	W. F. Steffens
	P. Swenson	W. F. Steffens	E. B. Ashby	S. C. Tanner
	G. W. Rear	E. B. Ashby	S. C. Tanner	Lee Jutton
	W. F. Steffens	C. E. Smith	Lee Jutton	W. F. Strouse
	E. B. Ashby	S. C. Tanner	W. F. Strouse	C. R. Knowles
	W. O. Eggleston	Lee Jutton	C. R. Knowles	A. Ridgway

	1915-1916	1916-1917	1917-1918	
President	G. W. Rear	C. E. Smith	S. C. Tanner	
1st. V.-Pres.	C. E. Smith	E. B. Ashby	Lee Jutton	
2nd V.-Pres.	E. B. Ashby	S. C. Tanner	F. E. Weise	
3rd V.-Pres.	S. C. Tanner	Lee Jutton	W. F. Strouse	
4th V.-Pres.	Lee Jutton	F. E. Weise	C. R. Knowles	
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	
Executive Members	F. E. Weise	W. F. Strouse	A. Ridgway	
	W. F. Strouse	C. R. Knowles	J. S. Robinson	
	C. R. Knowles	A. Ridgway	J. P. Wood	
	A. Ridgway	J. S. Robinson	D. C. Zook	
	J. S. Robinson	J. P. Wood	A. B. McVay	
	J. P. Wood	D. C. Zook	J. H. Johnston	

CONSTITUTION *

ARTICLE I.

NAME.

SECTION 1. This association shall be known as the American Railway Bridge & Building Association.

ARTICLE II.

OBJECT.

SECTION 1. The object of this association shall be the advancement of knowledge pertaining to the design, construction and maintenance of railway bridges, buildings and other structures, by investigation, reports and discussions, providing a medium for the exchange of ideas to the end that bridge and building practice may be systematized and improved.

SECTION 2. The association shall neither indorse nor recommend any particular devices, trade marks or materials, nor will it be responsible for any opinions expressed in papers, reports or discussions unless the same have received the endorsement of the association in regular session.

ARTICLE III.

MEMBERSHIP.

SECTION 1. The membership of this association shall be divided into two classes—active and life members.

SECTION 2. To be eligible for active membership, a person must be actively employed in railway service in responsible charge of the design, construction or maintenance of railway bridges, buildings or other structures; a professor of engineering in a college or university of recognized standing; an engineering editor, or a government or private timber expert

SECTION 3. To be eligible for life membership a person must have been a member of the association for at least five years and in general must have retired from active railway service. The association, however, may waive the latter condition by a majority vote of the members at a regular session for good and sufficient reasons. A life member shall have all the privileges of active membership and shall not be required to pay annual dues.

SECTION 4. Any member guilty of conduct unbecoming a railroad officer and a member of this association, or who shall refuse to comply with the rules of this association, may forfeit his membership on a two-thirds vote of the members present at any regular session of the association.

SECTION 5. Membership shall continue until written resignation is received by the secretary, unless member has been previously expelled, or dropped for non-payment of dues in accordance with Section 1 of Article VII.

* Revised October, 1914. Amended October, 1915.

ARTICLE IV.

OFFICERS.

SECTION 1. The officers of this association shall be a president, four vice-presidents, a secretary-treasurer and six executive members, all of whom shall constitute the executive committee.

SECTION 2. The past presidents of this association who continue to be members shall be entitled to be present at all meetings of the executive committee, of which meetings they shall receive due notice, and be permitted to discuss all questions and to aid said committee by their advice and counsel; but said past presidents shall not have a right to vote, nor shall their presence be requisite in order to constitute a quorum.

SECTION 3. Vacancies in any office for the unexpired term shall be filled by the executive committee without delay.

ARTICLE V.

EXECUTIVE COMMITTEE.

SECTION 1. The executive committee shall exercise a general supervision over the financial interests of the association, assess the amount of annual and other dues, call, prepare for and conduct general or special meetings and make all necessary purchases and contracts required to conduct the general business of the association, but shall not have the power to render the association liable for any debt beyond the amount then in the treasury not subject to other prior liabilities. All appropriations for special purposes must be acted upon at a regular meeting of the association.

SECTION 2. Two-thirds of the members of the executive committee may call special meetings, thirty days' notice being given members by mail.

SECTION 3. Five members of the executive committee shall constitute a quorum for the transaction of business.

ARTICLE VI.

ELECTION OF OFFICERS AND TENURE OF OFFICE.

SECTION 1. Except as otherwise provided the officers shall be elected at the regular annual meeting of the association which convenes on the third Tuesday in October, and the election shall not be postponed except by unanimous consent of the members present at said annual meeting. The election shall be by ballot, a majority of the votes cast being required for election. Any active member of the association not in arrears for dues shall be eligible for office, but the president shall not be eligible for reëlection.

SECTION 2. The president, four vice-presidents and secretary-treasurer shall hold office for one year and the executive members for two years, three being elected each year. All officers will retain their offices until their successors are elected and installed.

SECTION 3. The term of office of the secretary-treasurer may be terminated at any time by a two-thirds vote of the executive committee. His compensation shall be fixed by a majority vote of the executive committee. The secretary-treasurer shall also serve as secretary of the executive committee.

SECTION 4. The secretary-treasurer shall be required to give bond in an amount to be fixed by the majority of the executive committee.

ARTICLE VII.

ANNUAL DUES.

SECTION 1. Every member upon joining the association shall pay to the secretary-treasurer three dollars membership fee and two dollars per year in advance for annual dues. No member one year in arrears for dues shall be entitled to vote at any election, and any member more than one year in arrears shall be stricken from the list of members at the discretion of the executive committee.

ARTICLE VIII.

AMENDMENTS.

SECTION 1. This constitution may be amended at any regular meeting by a two-thirds vote of the members present, provided that notice of the proposed amendment or amendments has been sent to the members at least sixty days previous to said regular meeting.

BY-LAWS*

TIME OF MEETING.

1. The regular meeting of this association shall convene annually on the third Tuesday in October at 10 a. m.

PLACE OF MEETING.

2. Places of holding the next annual convention may be proposed at any regular session of the association. All the places proposed shall be submitted to a ballot vote of the members present at the annual business session and the place receiving a majority of all votes cast shall be declared the location of the next annual meeting. If no place receives a majority of the votes cast, the place receiving the lowest number of votes shall be dropped on each subsequent ballot until a place is chosen.

3. It shall lie within the power of the executive committee to change the location of the meeting place if it becomes apparent that it is for the best interests of the association.

QUORUM.

4. At the regular meeting of the association, fifteen or more members shall constitute a quorum.

DUTIES OF OFFICERS.

5. The president shall have general supervision over the affairs of the association. He shall preside at all meetings of the association and of the executive committee; shall appoint all committees not otherwise provided for, and shall be ex-officio member of all committees. He shall,

* Revised October, 1914. Amended October, 1915.

with the secretary-treasurer, sign all contracts or other written obligations of the association which have been approved by the executive committee. At the annual meetting the president shall present a report containing a statement of the general condition of the association.

6. The vice-presidents in order of seniority shall preside at meetings in the absence of the president and discharge his duties in case of a vacancy in his office.

7. It shall be the duty of the secretary-treasurer to keep a correct record of proceedings of all meetings of this association; to keep correct all accounts between this association and its members; to collect all moneys due the association, and deposit the same in the name of the association. He shall invest all funds not needed for current disbursements as shall be ordered by the executive committee. He shall pay all bills, when properly certified and approved by the president, and make such reports as may be called for by the executive committee. He shall also perform such other duties as the association may require.

NOMINATING COMMITTEE.

8. After each annual meeting the president shall appoint a committee of five members, not officers of the association, of whom two at least shall be past presidents, and two of whom shall have served on the committee the previous year, which shall prepare a list of names of nominees for officers to be voted on at the next annual convention, in accordance with Article VI of the constitution, said list to be read at the first session of the second day of said convention. Nothing in this section shall be construed to prevent any member making further nominations.

AUDITING COMMITTEE.

9. At the first session of each annual meeting the president shall appoint a committee of three members, not officers of the association, whose duty it shall be to examine the accounts and vouchers of the secretary-treasurer and certify as to the correctness of his accounts. Acceptance of this committee's report will be regarded as the discharge of the committee.

COMMITTEE ON SUBJECTS FOR DISCUSSION.

10. After the annual meeting the president shall appoint a committee whose duty it shall be to prepare a list of subjects for investigation to be submitted for approval at the next convention.

COMMITTEES ON INVESTIGATION.

11. After the association has adopted the list of subjects for investigation the president for the succeeding year shall appoint the committees who shall prepare the subjects for report and discussion. He may also appoint individual members to prepare reports on special subjects, or to report on any special or particular subject.

PUBLICATION COMMITTEE.

12. After each annual meeting the executive committee shall appoint a publication committee consisting of three active members whose duty it shall be to coöperate with the secretary in the issuing of the publications of the association. The assignment of this committee shall be such that at least one member shall have served on the committee during the previous year.

ORDER OF BUSINESS.

13. 1st—Registration of members.
2nd—Reading minutes of the last meeting.
3rd—Admission of new members.
4th—President's address.
5th—Report of secretary-treasurer.
6th—Payment of annual dues.
7th—Appointment of special committees.
8th—Reports of standing committees.
9th—Unfinished business.
10th—New business.
11th—Election of officers and selection of place for holding next annual meeting.
12th—Installation of officers.
13th—Adjournment.

(Report of nominating committee to be read at first session of second day—Section 9 of By-Laws.)

DECISIONS.

14. The votes of a majority of the members present shall decide any question, motion or resolution which shall be brought before the association, unless otherwise provided.

DISCUSSIONS.

15. All discussions shall be governed by Robert's rules of order.

DIRECTORY OF MEMBERS

Aagaard, P., Chief Inspector, I. C. R. R., Chicago.
Ailes, N. C., Asst. Val. Engr., D. & H. Co., Albany, N. Y.
Airmet, E. S., For. Ptr., O. S. L. R. R., Salt Lake City.
Alexander, W. E., Supt. B. and B., B. & A. R. R., Houlton, Me.
Allard, E. E., For. B. & B., Mo. Pac. Ry., St. Louis.
Allen, T. H., Supv. B. & B., C. & O. Ry., Hinton, W. Va.
Althof, L. W., Asst. Maint. Engr., U. P. R. R., Omaha, Neb.
Anderson, August, Gen'l For. B. and B., L. S. & I. Ry., Marquette, Mich.
Anderson, L. J., For. B. and B., C. & N. W. Ry., Escanaba, Mich.
Andrews, G. W., Asst. to Eng. M. of W., B. & O. R. R., Baltimore, Md.
Andrews, T. O., Ind. & Frankfort R. R., Lebanon, Ind.
Archbold, H. L., Asst. Engr., Sou. Pac. Co., Los Angeles, Cal.
Arey, R. J., 541 So. Cummings St., Los Angeles, Cal.
Ashby, E. B., Consulting Engr., L. V. R. R., New York City.
Ashmore, A. B., Supv. B. & B., M. L. & T. Co., Lafayette, La.
Ashton, D. H., Asst. Engr., L. A. & S. L. R. R., Salt Lake City.
Auge, E. J., Chief Carp., C. M. & St. P. Ry., Wells, Minn.
Austin, C. P., 107 Park St., Medford, Mass.

Bach, C. F., For. B. & B., C. & N. W. Ry., Belle Plaine, Iowa.
Bailey, F. W., Supt. M. of W., S. A. & A. P. Ry., Yoakum, Tex.
Bailey, S. D., M. C. R. R., Detroit, Mich.
Ball, E. E., Div. Engr., A. T. & S. F. Ry., Fresno, Cal.
Ballard, C. F., Carp. For., S. A. L. Ry., Peachland, N. C.
Baluss, F. C., Engr. B. & B., D. M. & N. Ry., Duluth, Minn.
***Barber, N. N.,** Stone & Webster Eng. Corp., Rock Island, Ill.
Barger, T. R., For. B. & B., L. & N. W. R. R., Homer, La.
Barnes, O. F., Div. Engr., Erie R. R., Jersey City, N. J.
Barrett, E. K., Supvr. B. and B., F. E. C. Ry., St. Augustine, Fla.
Barrett, J. E., Supt. of Track, B. and B., L. & H. R. Ry., Warwick, N. Y
Barry, E. J., Bldg. Insp., D. L. & W. R. R., Hoboken, N. J.
Barton, M. M., 311 No. 34th St., Philadelphia, Pa.
Bates, Onward, Civil Engineer, McCormick Bldg., Chicago.
Beal, F. D., 800 Fife Bldg., San Francisco, Cal.
Bean, C. C., Contractor, 243 Benton St., Freeport, Ill.
Beard, A. H., 705 No. 11th St., Reading, Pa.
Beckman, B. F., Engr., F. S. & W. R. R., Fort Smith, Ark.
Beeler, C. L., Asst. Engr., N. Y. N. H. & H. R. R., New Haven, Conn.
Beeson, R. W., Div. For. B. and B., C. & S. Ry., Trinidad, Colo.
Bender, Henry, For. B. & B., C. & N. W. Ry., Eagle Grove, Ia.
Benz, F. A., Div. Engr., B. R. & P. Ry., E. Salamanca, N. Y.
Berry, J. S., Supt. B. and B., S. L. S. W. Ry., St. Louis, Mo.
Bibb, J. M., Supvr. B. and B., L. & N. R. R., Birmingham, Ala.
Bigelow, F. M., Supv. B. & B., L. A. & S. L. R. R., Salt Lake City.
Bishop, McClellan, Mast. Carp., C. R. I. & P. Ry., El Reno, Okla
Bishop, R. R., For. B. and B., L. A. & S. L. R. R., Salt Lake City.
Black, G. W., Supt. McGrath Sand & Gravel Co., Pekin, Ill.

***In the National Service.**

Black, J. D., Supvr. B. and B., P. M. R. R., Saginaw, Mich.
Blake, L. M., Supv. B. & B., B. & M. R. R., St. Johnsbury, Vt.
Blowers, S. H., For. Carp., B. & O. R. R., Columbus, O.
Bock, J. G., Gen. Br. Insp., C. St. P. M. & O. Ry., St. Paul, Minn.
Bohland, J. A., Br. Engr., G. N. Ry., St. Paul, Minn.
Bonner, J. K., Asst. Supvr. B. & B., N. Y. C. R. R., Rochester, N. Y.
Bourgeois, F. J., Supv. B. & B., N. O. G. N. R. R., Bogalusa, La.
Bouton, W. S., Engr. of Bridges, B. & O. R. R., Baltimore Md.
Bowers, Stanton, Mast. Carp., P. C. C. & St. L. Ry., Bradford, O.
Bowers, S. C., Mast. Carp. of Brdgs.. P. C. C. & St. L. Ry., Steubenville. O.
Bowman, R. M., Hw. Engr., Office of Public Roads, Washington, D. C.
Boyd, G. E., Div. Engr., D. L. & W. R. R., Buffalo, N. Y.
Boyer, Grant, Div. For. B. & B., M. C. R. R., Detroit, Mich.
Brantner, Z. T., Supt. M. of W. Shops, B. & O. R. R., Martinsburg, W. Va.
Bratten, T. W., Supvr., B. and B., S. P. Co., Oakland Pier, Cal.
Brewer, W. A., Asst. Engr., I. C. C., 914 Karpen Bldg., Chicago.
Bricker, H. R., Inspr. M. of W., B. & O. R. R., Baltimore, Md.
Bridges, T. H., Asst. For. B. & B., St. L. I. M. & S. Ry., McGehee, Ark.
Briggs, B. A., 311 E. Cache la Paudre St., Colorado Springs, Colo.
Brookhart, N. D., Supv. B. & B., O. S. L. R. R., Pocatello, Idaho.
Brooks, G. E., Mast. Carp., C. R. I & P. Ry., Rock Island, Ill.
Brown, Alf., B. & B. Inspr., P. E. Ry., Los Angeles, Cal.
Brown, C. W., Sou. Pac. Co., Mina, Nevada.
Brown, E. H., Supv. B. & B., N. P. Ry., Minneapolis, Minn.
Brown, Thos., Br. Inspr., P. M. R. R., Saginaw, Mich.
Browne, J. B., Gen'l For. B. and B., K. C. C. & S. Ry., Clinton, Mo.
Browne, J. S., Asst. Engr., N. Y. N. H. & H. R. R., New Haven, Conn.
Bruce, R. J., Genl. Bldg. Inspr., Mo. Pac. Ry., St. Louis, Mo.
Buck, A. J., Chief Carpenter, C. M. & St. P. Ry., Tacoma, Wash.
Buckley, J. E., Supvr. B. & B., B. & M. R. R., Nashua, N. H.
Bulger, Hugh, For. B. & B., Sou. Pac. Co., Oakland Pier, Cal.
Burckhalter, F. L., Supt. Sou. Pac. Co., Portland, Ore.
Burgess, W. H., Supvr. B. & B., Sou. Pac. Co., Stockton, Cal.
Burke, Daniel, Supvr. B. and B., Sou. Pac. Co., Tucson, Ariz.
Burnett, W. L., For. B. & B., St. L. I. M. & S. Ry., Eudora, Ark.
Burns, W. E., Asst. Eng., S. P. Co., San Francisco (care of G. W. Rear).
Burpee, Moses, Chief Engr., B. & A. R. R., Houlton, Maine.
Burrell, F. L., Gen'l For. B. and B., C. & N. W. Ry., Fremont, Neb.
Byrd, J. E., Asst. For. B. & B., St. L. I. M. & S. Ry., McGehee, Ark.
Byrd, L. J., For. B. & B., St. L. I. M. & S. Ry., Dermott, Ark.
Byrd, W. E., Asst. For. B. & B., St. L. I. M. & S. Ry., McGehee, Ark.

Cahill, E., Genl. For. B. & B., D. L. & W. R. R., Scranton, Pa.
Caldwell, J. M., Insp. B. and B., C. I. & L. Ry., Lafayette, Ind.
Caldwell, J. T., For. B. & B., Sou. Pac. Co., Bakersfield, Cal.
Camp, W. M., Editor, Railway Review, Chicago, Ill.
Candee, Eldridge E., Sup B & B, N Y N H &HRR, New London, Conn.
Candee, Elliot E., Dist. Br. For., N Y N H & H R R, Waterbury, Conn.
Canty, J. P., Supvr. B. and B., B. & M. R. R., Fitchburg, Mass.
Cardwell, W. M., Mast. Carp., W. T. Co., Washington, D. C.
Carmichael, Wm., St. J. & G. I. R. R., St. Joseph, Mo.
Carpenter, J. T., 1101 Upper 3rd St., Evansville, Ind.
Cary, E. L., Richmond, Mo.
Case, F. M., For. W. S., C. & N. W. Ry., Belle Plaine, Ia.
Casey, W. W., For. B. & B., K. C. S. Ry., Texarkana, Texas.
Catchot, A. J., Supvr. B. & B., L. & N. R. R., Ocean Springs, Miss.
Cayley, W., Supvr., G. T. Ry., Stratford, Ont.
Clark, H. W., Supv. B. & B., Mo. Pac. R. R., Atchison, Kans.
Clark, J. H., Asst. Engr., Sou. Pac. Co., Los Angeles, Cal.
Clark, W. A., Chief Engr., D. & I. R. R. R., Duluth, Minn.
Clopton, A. S., Supvr. B. & B., M. K. & T. Ry., Oklahoma City, Okla.

Clothier, E. E., Chief Carp., C. M. & St. P. Ry., Mobridge, So. Dak.
Coffin, S. P., Supv. B. & B., B. & M. R. R., Charlestown, Mass.
Collings, Edwd., Chief Carp., C. M. & St. P. Ry., Perry, Iowa.
Cole, J. E., Gen'l Inspr., Sou. N. E. Ry., Providence, R. I.
Conn, F. J., Supvr. B. & B., C. N. O. & T. P. Ry., Lexington, Ky.
Cooper, H. A., Roadmaster, T. I. Ry., Gananoque, Ont.
Copland, A. C., Office Engr., C. & O. Ry., Richmond, Va.
Copp, J. P., 2626 Bond Ave., E. St. Louis, Ill. (Roberts & Schæffer Co.)
Corbin, W. S., For. B. and B., Sou. Pac. Co., San Pedro, Cal.
Corey, S. T., Ch. Dftsman, Br. Dept., C. R. I. & P. Ry., Chicago.
Cota, G. M., Ch. Clerk, Eng. Dept., C. Vt. Ry., St. Albans, Vt.
Counts, D. E., Supv. B. & B., W. & A. R. R., Dalton, Ga.
Cowsert, L. A., Supv. W. S., C. N. O. & T. P. Ry., Danville, Ky.
Crawford, J. A., B. & B. Master, C. N. Ry., Saskatoon, Sask.
Crites, G. S., Asst. Engr., B. & O. R. R., Baltimore, Md.
Cronin, Jno., For. B. & B., C. & N. W. Ry., Winona, Minn.
Crosman, D. M., Asst. Engr., Sou. Pac. Co., Los Angeles, Cal.
Cullen, F. P., For. B. & B., O. S. L. R. R., Pocatello, Idaho.
Cullen, J. F., For. B. & B., O. S. L. R. R., Pocatello, Idaho.
Cummin, Joseph H., Brightwaters, N. Y.
Cunningham, A. O., Chief Engr., Wabash R. R., St. Louis, Mo.
Curtin, William, Contractor, Govan, Saskatchewan.

Dale, Chas., For. W. S., I. C. R. R., New Orleans, La.
Dalstrom, O. F., Bridge Engr., C. & N. W. Ry., Chicago.
Danes, E. C., Gen. For., Wabash R. R., Peru, Ind.
Danes, W. S., Engr. M. of W., Wabash R. R., Peru, Ind.
Decker, H. H., Contractor, 2915 Ingersoll Ave., Des Moines, Ia.
Degnan, L. V., 1834 Hearst Ave., Berkeley, Cal.
Demars, E. A., G. F. Plumb. & W. S., O. S. L. R. R., Salt Lake City.
Derr, W. L., Supt., C. G. W. R. R., Clarion, Iowa.
Dickerson, O. H., Prin. Asst. Engr., D. & I. R. R. R., Duluth, Minn.
Dickson, Geo., For. Brdgs., Sou. Pac. Co., Oakland, Cal.
Dickson, G. H., Asst. Engr., B. & B., T. & N. O., Ry., North Bay, Ont.
Dittmar, F. C., Br. For., Sou. Pac. Co., Los Angeles, Cal.
Donaldson, C. E., Actg. G. F. B. & B., C. Vt. R. R., St. Albans, Vt.
Douglas, L. H., Mast. Carp., B. & O. R. R., Cleveland, O.
Drake, R. M., M. of W. Asst., Sou. Pac. Co., San Francisco, Cal.
Draper, F. O., Supt. of Bridges, I. C. R. R., Chicago.
Draper, I. A., Steel Erec. For., O. S. L. R. R., Pocatello, Idaho.
Drum, H. R., Chief Carp., C. M. & St. P. Ry., Mitchell, S. D.
Duckett, W. E., Asst. Engr., C. M. & St. P. Ry., Minneapolis, Minn.
Dufort, S. E., Supv. B. & B., B. & M. R. R., Concord, N. H.
Dupree, James, For. W. S., C. T. H. & S. E. Ry., Crete, Ill.
Durfee, T. H., For. B. and B., C. & N. W. Ry., Huron, S. D.

Easton, G. A., Gen. Scale Insp., Sou. Pac. Co., West Oakland, Cal.
Edwards, W. R., Sr. Struct. Engr., I. C. C., Washington, D. C.
Eggers, C. H., Mast. Carp., C. R. I. & P. Ry., Little Rock, Ark.
Eggleston, H. H., Supvr. B. & B., C. G. W. R. R., Des Moines, Ia.
Eggleston, W. O., Insp. of Bridges, Erie R. R., Huntington, Ind.
Elder, W. E., Mast. Carp., C. B. & Q. R. R., Burlington, Iowa.
Elliott, R. O., Supvr. B. and B., L. & N. R. R., Nashville, Tenn.
Elwell, H. A., Supvr. B. & B., C. G. W. Ry., Clarion, Ia.
Esping, Chas., Mast. Carp., B. & O. C. T. R. R., Chicago.
Estes, C. F., For. Brdgs., Pac. Elec. Ry., Los Angeles, Cal.
Ettinger, C., Gen. Ptr. For., I. C. R. R., Chicago.
Eubanks, J. E., Br. For., S. A. L. Ry., Yulee, Fla.
Evans, J. J., Supvr. Signals, P. M. R. R., Saginaw, Mich.

Fair, E. W., Supvr. B. & B., B. R. & P. Ry., Du Bois, Pa.
Fake, C. H., Engr. M. of W., M. R. & B. T. Ry., Bonne Terre, Mo.
Farlow, R. F., Mast. Carp., B. & O. S. W. R. R., Chillicothe, O.
Faulkner, L. E., Ch. Engr., Miss. Cent. R. R., Hattiesburg, Miss.
Fellows, C. W., For. W. S., C. & S. Ry., Denver, Colo.
Fenwick, G. H., Gen. Br. For., M. C. R. R., St. Thomas, Ont.
Ferdina, A. H., For. B. & B., St. L. I. M. & S. Ry., St. Louis.
Ferris, B. F., For. B. and B., Sou. Pac. Co., Los Angeles.
Findley, A., 929 Wash. Ave., Portland, Me.
Fink, Albert, Gen. For. B. &. B., D. L. & W. R. R., Buffalo, N. Y.
Finley, W. H., Ch. Engr., C. & N. W. Ry., Chicago.
Fisher, J. F., Bridge Inspr., Sou. Pac. Co., Sacramento, Cal.
Fisher, Morris, Supvr. B. & B., Sou. Pac. Co., Ogden, Utah.
Fisk, C. H., Ch. Engr. Const., St. Louis, 5142 Westminster Pl., St. Louis.
Fitzgerald, J. M., Roadmaster, C. of G. Ry., Macon, Ga.
Fletcher, J. W., Roadway Supt., Car. & N. W. Ry., Chester, S. C.
Fletcher, W. H., 108 7th Ave., Nashville, Tenn.
Flint, C. F., For. B. and B., C. V. R. R., St. Albans, Vt.
Flynn, M. J., For. B. and B., C. & N. W. Ry., Chicago.
Forsgren, Oscar, Brigham, Utah.
Fraser, Alex., Supvr. B. & B., Sou. Pac. Co., Bakersfield, Cal.
Fraser, James, Ch. Engr., N. S. W. Govt. Rys., Sydney, N. S. W.
Fraser, Neil, Supv. B. & B., Sou. Pac. Co., Dunsmuir, Cal.
Frazier, W. C., Supvr. B. and B., L. A. & S. L. Ry., Los Angeles.
Froese, Julius, Gen. For. B. & B., A. T. & S. F. Ry., LaJunta, Colo.
Fullerton, J. H., Supv. B. & B., B. & M. R. R., Woodsville, N. H.

Gable, Franklin, For. Carp., P. & R. Ry., Catawissa, Pa.
Gaby, F. A., Ch. Engr. P. C. of Ont., Toronto, Ont.
Gagnon, Ed., Supvr. B. and B., M. & St. L. R. R., Minneapolis, Minn.
Galloway, W. J., Mast. Carp., S. A. L. R. R., Hamlet, N. C.
Gardner, E. F., Mast. Carp., Erie R. R., Buffalo, N. Y.
Garner, R. D., Engr. Const., S. N. E. Ry., Providence, R. I.
Gaunt, Fred, Ptr. For., O. S. L. R. R., Pocatello, Idaho.
Gaut, J. B., Supt. B. & B., G. T. Ry., Chicago.
***Gauthier, A. I.,** Supvr. B. & B., B. & M. R. R., Concord, N. H.
Gehr, B. F., Mast. Carp., P. C. C. & St. L. Ry., Richmond, Ind.
Gentis, Ira, B. and B. Foreman, Sou. Pac. Co., Oakland, Cal.
George, W. J., Bay Road, Claremont, W. Australia.
Gerst, H. A., Asst. Engr., Bridge Dept., G. N. Ry., St. Paul, Minn.
***Gilman, A. F.,** 1310 Hinman Ave., Evanston, Ill.
Giusto, Peter, For. B. & B., Sou. Pac. Co., San Francisco.
***Given, J. A.,** Asst. Div. Engr., Sou. Pac. Co., Sacramento, Cal.
Glasgow, J. F., Gen For B & B, C St P M & O Ry, Worthington, Minn.
Gnadt, C., Br. For., St. L. I. M. & S. Ry., Poplar Bluff, Mo.
Goldmark, Henry, Cons. Engr., 103 Park Ave., New York City.
Goldsmith, E. L., Supt. Const., L. I. R. R., Jamaica, N. Y.
Gooch, C. W., 1325 W. 9th St., Des Moines, Ia.
Gongoll, O. C., Asst. Supt. B. & B., Soo Line, Minneapolis, Minn.
Gradt, Chas. Ch. Carp., C. M. & St. P. Ry., Savanna, Ill.
Graham, F. N., Asst. Engr., D. M. & N. Ry., Duluth, Minn.
Graham, Wm., C. E., 3027 Windsor Ave., Baltimore, Md.
Gratto, James, Supvr. B. & B., S. P. Co., Los Angeles, Cal.
Graves, Lon, For. B. & B., St. L. I. M. & S. Ry., Dermott, Ark.
Green, C. F., Supvr. B. and B., Sou. Pac. Co., Sacramento, Cal.
Green, E. H. R., Pres., Texas Midland R. R., Terrell, Tex.
Green, Z. A., Pilot, Fed. Val., G. C. & S. F. Ry., Galveston, Tex.
Greiner, J. E., Civil Engineer, 605 Continental Bldg., Baltimore, Md.
Griffith, F. M., Supvr. B. and B., C. & O. Ry., Covington, Ky.
Grover, J. H., Gen. For. W. S., A. T. & S. F. Ry., Needles, Cal.
Guild, Edward, Supv. B. & B., P. M. R. R., Grand Ledge, Mich.

Guire, W. A., For. B. & B., St. L. I. M. & S. Ry., Lake Providence, La.
***Guppy, B. W.**, Engr. Structures, B. & M. R. R., Boston, Mass.
Guretzky, J., Supvr. B. &. B., Col. Mid. Ry., Colorado City, Colo.

Hadwen, L. D., Engr. Masy. Const., C. M. & St. P. Ry., Chicago, Ill.
Haley, W. S., Res. Engr., N. Y. C. R. R., Toledo, O.
Hall, N. L., Supvr. B. & B., Sou. Ry., Greensboro, N. C.
Hall, Thomas, Asst. Supt. Bldgs., M. C. R. R., Jackson, Mich.
Hampton, H. A., Asst. Div. Engr., Sou. Pac. Co., Portland, Oregon.
***Hancock, John**, Engr. B. & B., U. Trac. Co. of Ind., Anderson, Ind.
Hand, Geo. W., Valuation Engr., C. & N. W. Ry., Chicago.
Hanks, G. E., 814 No. Wash. Ave., Saginaw, Mich.
Hansen, Robt., Carp. For., Sou. Pac. Co., West Oakland, Cal.
Hansen, Rupert, 517 Redondo Ave., Salt Lake City, Utah.
Hargrove, J. C., For. B. & B., St. L. I. M. & S. Ry., McGehee, Ark.
Harlow, A. W., Mast. Carp., Erie R. R., Huntington, Ind.
Harman, H. H., Engr. of Brs., B. & L. E. R. R., Greenville, Pa.
Harman, Wm. C., Br. Inspr., Sou. Pac. Co., Bakersfield, Cal.
Harris, C. J., For. B. and B., O. S. L. R. R., Roberts, Idaho.
Harris, W. B., Supv. of Track, M. & O. R. R., Corinth, Miss.
Harrison, Chas., Gen. For. B. & B., M. O. & G. Ry., Muskogee, Okla.
Harshbarger, C. A., Asst. Br. For., O. S. L. Ry., Ontario, Ore.
Hartley, James, Supvr. B. and B., N. P. Ry., Staples, Minn.
Harvey, E. H., St. L. I. M. & S. Ry., Montrose, Ark.
Hausgen, W., Supvr. B. and B., M. P. Ry., Sedalia, Mo.
Hawk, A. T., Archt., C. R. I. & P. Ry., Chicago.
Hawkins, E. P., Genl. R. M., St. L. I. M. & S. Ry., McGehee, Ark.
Hayes, J. L., Div. Engr., C. R. I. & P. Ry., Rock Island, Ill.
Heiszenbuttel, H., Genl. For. B & B., C. &. N. W. Ry., Norfolk, Neb.
Henderson, J., Foreman B. and B., G. T. Ry., St. Thomas, Ont.
Henderson, R. C., Mast. Carp., C. H. & D. Ry., Dayton, O.
Herrig, C., For. W. S., C. & N. W. Ry., Wall Lake, Iowa.
Hicks, Wm. G., M. of W. Dept., L. I. R. R., Jamaica, N. Y.
Higgins, H. K., Cons. Engr., 209 McBride St., Jackson, Mich.
Hill, H. R., Asst. Supvr. B. & B., L. & N. R. R., Birmingham, Ala.
Hinchee, J. M., For. B. & B., Sou. Pac. Co., Los Angeles, Cal.
Hitesman, U. S., Gen. For., N. Y. C. R. R., New York City.
Hodges, F. J., C. C., M. C. R. R., Jackson, Mich.
Hodges, H. P., Asst. Engr. W. S., N. C. & St. L. Ry., Nashville, Tenn.
Hofecker, Peter, Supvr. B. and B., L. V. R. R., Auburn, N. Y.
Hoffman, Geo. M., For. Ptr., P. & R. Ry., Shamokin, Pa.
Holcomb, J. W., Supvr. B. & B., L. V. R. R., Buffalo, N. Y.
Holdridge, H. D., Supvr. B. and B., Y. & M. V. R. R., Vicksburg, Miss.
Hopke, W. T., Mast. Carp., B. & O. R. R., Grafton, W. Va.
Horning, H. A., Supt. of Bldgs., M. C. R. R., Jackson, Mich.
Horth, A. J., Mast. Carp., Erie R. R., Meadville, Pa.
Hotson, Wm. B., Supt. B. & B., E. J. & E. Ry., Joliet, Ill.
Howson, E. T., Eng. Editor, Railway Age Gazette, Chicago, Ill.
Hubbard, A. B., 32 Banks St., West Somerville, Mass.
Hudson, B. M., Supt. T. & B. V. Ry., Teague, Tex.
Hull, K. S., Supt., G. C. & S. F. Ry., Temple, Tex.
Humbert, A. T., Mast. Carp., B. & O. R. R., New Castle Jct., Pa.
Hume, E. S., Deputy Com'r., W. A. Govt. Rys., Perth, W. Australia.
Hunciker, John, For. Bridge Erection, C. & N. W. Ry., Chicago.
Huntoon, J. S., Supv. Bridges, M. C. R. R., Detroit, Mich.
Hurst, Walter, Inspector, C. B. & Q. Ry., Chicago, Ill.
Hutchens, J. A., Bridge Insp., Sou. Pac. Co., Ogden, Utah.

Ingalls, F., Supvr. B. and B., N. P. Ry., Jamestown, N. D.
Ingram, Floyd, Supvr. B. and B., L. & N. R. R., Erin, Tenn.
Innes, J., Gen. For., G. T. Ry., Hamilton, Ont.

Irving, T. J., Asst. Engr., C. & N. W. Ry., Boone, Iowa.
Irwin, J. W., Genl. For. B. & B., C. & N. W. Ry., Chadron, Neb.
Isaacs, Jno. D., Consulting Engr., Sou. Pac. Co., New York City.

Jack, H. M., Gen'l For. B. and B., I. & G. N. R. R., Palestine, Tex.
Jackson, E. A., For. B. & B., St. L. I. M. & S. Ry., McGehee, Ark.
Jackson, W. J., Div. Engr., C. & N. W. Ry., Winona, Minn.
James, A. J., Gen. For. B. & B., A. T. & S. F. Ry., Topeka, Kans.
James, Harry, Gen'l For. B. and B., C. & S. Ry., Denver, Col.
James, R. E., Supv. B. & B., L. V. R. R., Sayre, Pa.
Jennings, Geo. H., Asst. Ch. Engr., E. J. & E. Ry., Joliet, Ill.
Jensen, C. A., For. B. & B., Sou. Pac. Co., Los Angeles, Cal.
Jewell, J. O., Supt. **B. and** B., **C. T. H. & S. E. Ry., Terre Haute, Ind**
Johnson, C. H., For. B. & B., P. M. R. R., Reese, Mich.
Johnson, Maro, Asst. Engr., I. C. R. R., Chicago.
Johnson, Nels, Supv. B. & B., C. G. W. R. R., St. Charles, Ill.
Johnson, Phelps, Pres. St. Lawrence Bridge Co., Montreal, Que.
Johnston, C. E., Genl. Mgr., K. C. Sou. Ry., Kansas City, Mo.
Johnston, J. H., Supt. B. & B., G. T. Ry., Montreal, Que.
***Jonah, F. G.,** Chief Engr., St. L. & S. F. R. R., St. Louis, Mo.
Jonas, H. F., Engr. Struct., S. P. Lines, Tex. & La., Houston, Tex
Jones, L. E., Asst. Engr., N. O. & N. E. R. R., New Orleans, La.
Jones Pusey, Act. Engr. Strs., B & M. R. R., Boston, Mass.
Joslin, Judson, Genl. For. B. & B., L. V. R. R., Auburn, N. Y.
Jutton, Lee, Div. Engr., C. & N. W. Ry., Chicago, Ill.

Keefe, D. A., Consulting Engr., Athens, Pa.
Keith, H. C., Civil Engineer, 154 Nassau St., New York City.
Kelly, C. W., Peoples Gas Building, Chicago.
Kelly, J. A., Asst. Supv. B. & B., O. S. L. R. R., Pocatello, Idaho,
Kemp, A. E., For. B. & B., L. V. R. R., Hazleton, Pa.
***Kibbey, G. S.,** Asst. Engr., M. & St. L. R. R., Minneapolis, Minn.
Killam, A. E., 84 Highfield St., Moncton, N. B.
King, A. H., Supvr. B. and B., O. S. L. R. R., Pocatello, Idaho.
King, C. F., Div. Engr., C. & N. W. Ry., Omaha, Neb.
King, F. E., Dist. Carp., C. M. & St. P. Ry., Minneapolis, Minn.
King, T. H., Supv. B. & B., L. & N. R. R., Knoxville, Tenn.
Kinzie, H. H., Supvr. B. and B., **N. Y. N. H. & H. R. R., Taunton, Mass**
Klumpp, G. J., Supvr. Bridges, N. Y. C. R. R., Rochester, N. Y.
Knapp, F. A., Mast. Carp., Erie R. R., Jersey City, N. J.
Knapp, G. A., Office Engr., G. C. & S. F. Ry., Galveston, Tex.
Knowles, C. R., Supt. Water Service, I. C. R. R., Chicago.
Krausch, W. T., Engr. Bldgs., C. B. & Q. R. R., Chicago, Ill.
Kulp, B. R., Trainmaster, C. & N. W. Ry., Antigo, Wis.
Kurokochi, S., Engineer, Imperial Govt. Rys., Tokyo, Japan.

Lacy, J. D., Insp., S. A. & A. P. Ry., 2517 Saltus St., Houston, Tex.
Lacy, W. J., For. B. & B., St. L. I. M. & S. Ry., Poplar Bluff, Mo.
La Fountain, N. H., Asst. Supt. of B. and B., C. M. & St. P. Ry., Chicago
Lamb, C. W., For. B. & B., St. L. I. M. & S. Ry., Pine Bluff, Ark.
Land, G. W., Supvr. B. and B., St. L. I. M. & S. Ry., McGehee, Ark.
Lanning, W. R., Ch. Carp., C. M. & St. P. Ry., St. Maries, Idaho.
Large, H. M., Mast. Carp., G. R. & I. Ry., Fort Wayne, Ind.
Larsen, A., Asst. Engr., C. Vt. Ry., St. Albans, Vt.
Larson, John, Room 740, Transportation Bldg., Chicago.
Lattin, W. V., Supv. B. & B., N. Y. N. H. & H. R. R., Hartford, Conn
Lawrence. P. P., Asst. Supvr. B. & B., L. E. & W. R. R., Tipton, Ind.
Layfield, E. N., C. E., 61 Broadway, N. Y.
Leach, W. A., 150 Essex St., Holyoke, Mass.
Leake, T. S., Contractor, 6433 Kenwood Ave., Chicago.

Leavitt, F. J., Div. For. B. and B., B. & M. R. R., Sanbornville, N. H.
Lee, Frank, Prin. Asst. Engr., C. P. R., Winnipeg, Manitoba.
Lemond, J. S., Asst. to Ch. Engr. M. of W. & S., Sou. Ry., Charlotte, N. C.
Lentz, C. W., Genl. Bridge Insp., I. C. R. R., Memphis, Tenn.
Leonard, H. R., Engr. B. and B., P. R. R., Philadelphia, Pa.
Leslie, Andrew, Div. For., M. C. R. R., St. Thomas, Ont.
Lewis, E. R., Asst. to G. M., D. S. S. & A. Ry., Duluth, Minn.
Lichty, C. A., Gen'l Insp., C. & N. W. Ry., Chicago.
Little, J. W., Asst. Supvr., B. & B., L. & N. R. R., Birmingham, Ala.
Littlefield, E. C., Ch. Clk., N. Y. N. H. & H. R. R., New Haven, Conn.
Lloyd, F. F., C. E., Petaluma, Cal.
Lodge, Harry, For. B. & B., Sou. Pac. Co., (care of G. W. Rear).
Loeffler, M., Supv. Brs., L. I. R. R., Jamaica, N. Y.
Loftin, E. L., Supvr. B. and B., **Q. & C. Ry., Vicksburg, Miss.**
Long, M. A., Asst. to Ch. Engr., B. & O. R. R., Baltimore, Md.
Lorch, J. A., Asst. Engr., C. & N. W. Ry., Chicago.
Loughery, E., Gen'l For. B. & B., T. & P. Ry., Dallas, Tex.
Loughnane, George, Div. Engr., C. & N. W. Ry., Escanaba, Mich.
Loweth, C. F., Ch. Engr., C. M. & St. P. Ry., Chicago.
***Lutken, P. K.,** Gen. For. B. & B., N. O. M. & C. R. R., Laurel, Miss.
Lydston, W. A., 105 Norfolk Ave., Swampscott, Mass.
Lyman, C. R., For. Brgs., C. Vt. Ry., Waterbury, Vt.

Mace, B. S., Supt. of Insurance, B. & O. R. R., Baltimore, Md.
Mackenzie, W. B., Civil Engineer, Moncton, N. B.
Macy, E. C., Supt. Const., Stone & Webster Eng. Corpn., 868 Stuart Bldg., Seattle, Wash.
Mahan, Wm., Mast. Carp., W. & L. E. R. R., Canton, Ohio.
Malloy, J. B., For. B. & B., Sou. Pac. Co., San Francisco.
Manley, B. F., Gen. For. B. & B., Pac. Elec. Ry., Los Angeles, Cal.
Mann, J. M., Gen'l For. B. and B., Ft. W. & D. C. Ry., Ft. Worth, **Tex.**
Manson, E. F., Mast. Carp., C. R. I. & P. Ry., Manly, Iowa.
Manthey, G. A., Asst. Supt. B. & B., Soo Line, Minneapolis, Minn.
Marcy, C. A., For. B. and B., C. & N. W. Ry., Chicago.
Markley, A. S., Mast. Carp., C. & E. I. R. R., Danville, Ill.
Markley, J. H., Mast. B. and B., T. P. & W. Ry., Peoria, Ill.
Marsh, John, For. B. and B., B. & M. R. R., Lawrence, Mass.
Marsh, M. M., Supt. W. & B., Northern Ry., Squirres, Costa Rica, C. A.
Maruyama, Y., C. E., Sou. Manchuria Ry., Dairen, Japan.
Massenburg, W. G., Engr. Gulf Lines, G. C. & S. F. Ry., Galveston, Tex.
Mathews, J. D., Div. Engr., Sou. Pac. Co., Tucson, Ariz.
Mattos, F. D., Supt. Pres. Wks., S. P. Co., W. Oakland, Cal.
May, A. D., Asst. Engr., Mo. Pac. Ry., Little Rock, Ark.
McCabe, E. M., Supv. B. & B., B. & A. R. R., Pittsfield, Mass.
McCallum, A. D., For. W. S., C. H. & D. Ry., Hamilton, O.
McCandless, C. W., For. B. & B., Sou. Pac. Co., Ventura, Cal
McCann, E., Gen. For. B. and B., A. T. & S. F. Ry., Wellington, **Kans.**
McCaulley, S. W., C. E., 1428 E. 68th St., Chicago, Ill.
McClanahan, S. L., Div. Engr., C. R. I. & P. Ry., Herington, Kans.
McCloy, A. L., For. B. & B., P. M. R. R., Reese, Mich.
McClure, J. C. E., Asst. Engr., Sou. Pac. Co., Los Angeles, Cal.
McCormick, R. S., Ch. Engr., A. C. & H. B. R., Sault Ste. Marie, Ont.
McCue, G. C., Gen. Supvr. B. & B., G. T. Ry., Ottawa, Ont.
McCully, C. S., Gen'l For. B. and B., N. P. Ry., Jamestown, **N. D.**
McDearmid, W. A., Mast. Carp., S. A. L. Ry., Charleston, S. C.
McDonald, Hunter, Ch. Engr., N. C. & St. L. Ry., Nashville, Tenn.
McFadden, T. E., Chief Carp., C. M. & St. P. Ry., Cedar Falls, Wash.
McGee, Danl., For. B. & B., Sou. Pac. Co., Sacramento, Cal.
McGonagle, W. A., Pres., D. M. & N. Ry., **Duluth, Minn.**
McGuire, Edwd., Ch. Carp., C. M. & St. P. Ry., Marion, Iowa.

McIlhenny, O. R., Asst. Supv., N. O. & N. E. R. R., Laurel, Miss.
***McIntosh, Wm.,** Castle Stuart, Dalcross, Inverness-shire, Scotland.
McIver, B. T., Supvr. B. and B., D. & I. R. R. R., Two Harbors, Minn.
McKay, A. G., Div. For. Bldgs., N Y N H & H R R., New Haven, Conn.
McKee, D. L., Mast. Carp., P. & L. E. R. R., McKee's Rocks, Pa.
McKee, H. C., Insp. of Iron Bridges, C. of G. R. R., Macon, Ga.
McKeel, W. S., Mast. Carp., G. R. & I. Ry., Grand Rapids, Mich.
McKibben, Robert, Mast. Carp., P. R. R., Altoona, Pa.
McLean, Neil, Bridge Inspector, Erie R. R., Huntington, Ind.
McLeod, Angus M., For. B. & B., Sou. Pac. Co., Oakland, Cal.
McNab, A., Supvr. B. and B., P. M. R. R., Holland, Mich.
McNaughton, H. C., Div. For. B. & B., B. & M. R. R., Concord, N. H.
McRae, D. A., Carp. For., C. P. R., Lethbridge, Alberta.
McRostie, Roy, Asst. For. Const., O. S. L. R. R., Pocatello, Ida.
McVay, A. B., Supvr. B. and B., L. & N. R. R., Evansville, Ind.
Mellgren, J., For. W. S., C. & N. W. Ry., Eagle Grove, Iowa.
Meloy, E. S., Asst. Engr., C. M. & St. P. Ry., Chicago.
Mercier, A. T., Asst. Supt., Sou. Pac. Co., Dunsmuir, Cal.
Meyer, H. W., Struct. Engr., Fairmont, W. Va.
Meyers, W. F., For. B. and B., C. & N. W. Ry., Boone, Iowa.
Middleton, R. J., Val. Engr., C. M. & St. P. Ry., Chicago, Ill.
Miller, A. F., Mast. Carp., Penn. Lines W. of Pitts., Chicago.
Miller, C. E., Asst. Gen. Br. Insp., C. & N. W. Ry., Chicago.
Miller, J. W., Archt., C. & N. W. Ry., Chicago.
Miller, M. D., Spl. Engr., 740 Transportation Bldg., Chicago.
Mills, R. P., Supvr. Bldgs., N. Y. C. R. R., New York City.
Mines, Chas., Gen. For. B. & B., C. St. P. M. & O. Ry., Emerson, Neb.
Mitchell, G. A., Supt. B. and B., G. T. Ry., Toronto, Ont.
Mitchell, L. A., Eng. M. & W., U. T. Co. of Ind.; Anderson, Ind.
Moen, J. D., Supt. B. & B., C. St. P. M. & O. Ry., St. Paul, Minn.
Montzheimer, A., Ch. Engr., E. J. & E. Ry., Joliet, Ill.
Moore, E. G., For. Carpenter, B. & O. R. R., Flatwoods, W. Va.
Moore, W. H., Eng. of Brgs., N. Y. N. H. & H. R. R., New Haven, Conn
Morgan, Homer, For. B. & B., P. M. R. R., Greenville, Mich.
Morrison, E. C., Div. Engr., Sou. Pac. Co., San Francisco.
Mountain, G. A., Ch. Engr., Ry. Com. of Canada, Ottawa, Ont.
Mountfort, Albert, Div. For. B. and B., B. & M. R. R., Nashua, N. H.
Mulcahy, W. H., For. B. & B., C. & N. W. Ry., Adams, Wis.
Munson, S. P., Chief Clerk, I. C. R. R., Mattoon, Ill.
Murphy, J. J., For. Water Service, Sou. Pac. Co., Oakland, Cal.
Murphy, R. E., For. B. & B., Sou. Pac. Co., Bakersfield, Cal.
Murray, J. R., Supvr. B. & B., A. G. S. R. R., Tuscaloosa, Ala.
Murray, Edwd., Asst. Engr. B. & B., C. M. & St. P. Ry., Miles City, Mont
Musgrave, C. T., For. B. & B., O. S. L. R. R., Idaho Falls, Idaho.
Musser, D. G., Mast. Carp., Penn. Lines W. of Pitts., Wellsville, Ohio

Nelson, J. C., Engr. M. of W., S. A. L. Ry., Norfolk, Va.
Nelson, M. E., Engr. Brdgs., A. C. L. R. R., Wilmington, N. C.
Nelson, O. T., Supt. M. of W., A. & W. P. R. R., Atlanta, Ga.
Nelson, P. N., Supv. B. & B., Sou. Pac. Co., San Francisco, Cal.
Newton, E. O., Div. For. Bldgs., N. Y. N. H. & H. R. R., Danbury, Conn.
Newton, R., For. B. & B., O. S. L. R. R., Pocatello, Idaho.
Nies, A. B., Archt., M. C. R. R., Jackson, Mich.
Noland, W. B., Supvr. B. & B., O. A. & E. Ry., Sacramento, Cal.
Noon, W. M., 617 Ave. G., Miami, Fla.
Nuelle, J. H., Genl. Supt., N. Y. O. & W. R. R., Middletown, N. Y.
Nuss, G. K., G. F. B. & B., D. M. & N. Ry., Proctor, Minn.

O'Connor, W. F., Supvr. Bridges, L. I. R. R., Flushing, N. Y.
Oldham, W. J., B. & B. Master, T. & N. O. Ry., North Bay, Ont.
Oliver, W. H., Div. Engr., A. T. & S. F. Ry., San Bernardino, Cal.
O'Neill, P. J., Mast. Carp., N. Y. C. R. R., Adrian, Mich.
Osborn, F. C., Cons. Engr., 2848 Prospect Ave., S. E., Cleveland, O.
Owen, John, For. B. & B., D. & M. Ry., East Tawas, Mich.

Page, A. A., Div. For. B. & B., B. & M. R. R., Wilmington, Mass.
Palmer, E. F., For. B. & B., B. & M. R. R., Salem, Mass.
Parker, J. F., Gen. For. B. & B., A. T. & S. F. Ry., San Bernardino, Cal
Parker, W. V., B. & B. Fr., St. L. S. W. Ry., Fordyce, Ark.
Parks, J., 3347 Boulevard F., Denver, Colo.
Parsons, P. E., Asst. Supv. B. & B., O. S. L. R. R., Pocatello, Idaho.
Paterson, E. E., Plumber For., O. S. L. R. R., Pocatello, Idaho.
Pauba, A. W., For. B. and B., C. & S. Ry., Denver, Colo.
Peabody, K., Asst. Supv. Bldgs., N. Y. C. R. R., New York City.
Penwell, J. N., Supt. Ogle Const, Co., Tipton, Ind.
Perkins, H. D., 1501 Walnut St., Danville, Ill.
Pettis, W. A., Gen. Supv. Bldgs., N. Y. C. R. R., Rochester, N. Y.
Phillips, B. P., Asst. Sup. B & B, N Y N H & H R R, Willimantic, Conn.
Pickering, B. F., Supvr. B. & B., B. & M. R. R.. Salem, Mass.
***Pickering, F. M.**, Trainman, B. & M. R. R., Salem, Mass.
Pierce, Roy, Mast. Carp., Erie R. R., Salamanca, N. Y.
Pinson, J. F., Asst. Engr. B. & B., C. M. & St. P. Ry., Seattle, Wash.
Piper, E. B., Div. For. B. & B., B. & M. R. R., Fitchburg, Mass.
Pitcher, C. G., For. B. & B., O. S. L. R. R., Pocatello, Idaho.
Plank, D. E. Supvr. B. and B., Pac. Elec. Ry., Los Angeles, Cal.
Pollard, Harry, Asst. Gen'l Br. Insp., S. P. Co., San Francisco, Cal.
Pollard, Homer, Bridge Inspr., Sou. Pac. Co., West Oakland, Cal.
Pollock, H. H., Mast. Carp. of Bldgs., P. C. C. & St. L. Ry., Carnegie, Pa.
Porter, L. H., Box 35, Andover, Conn.
Post, J. C., B. & B. For., L. A. & S. L. R. R., Los Angeles, Cal.
Potter, A. K., Inspector, C. & N. W. Ry., Antigo, Wis.
Potts, J. O., M. of W. Inspr., B. & O. R. R., Baltimore, Md.
Powell, C. E., Genl. Insp. Brgs., C. & O. Ry., Hinton, W. Va.
Powell, S. J., Div. For. B. & B.. O. S. L. R. R., Ogden, Utah.
Powers, G. F., Contractor (Newkirk & Powers), Joliet, Ill.

Quinn, William, Supt. B. & B., St. L. S. W. Ry., of T., Tyler, Tex.

Rankin, W. F., Mast. Carp., Pa. Lines West, Cambridge, Ohio.
Rask, A. G., Supvr. B. & B., C. St. P. M. & O. Ry., Altoona, Wis.
Ratliff, W. L., Supvr. B. & B., I. C. R. R., McComb, Miss.
Ray, G. T., Supv. B. & B., St. J. & G. I. R. R., Marysville, Kans.
Rear, G. W., Gen'l Insp., S. P. Co., San Francisco, Cal.
Redfield, J. A. S., Div. Engr., C. & N. W. Ry., Fond du Lac, Wis.
Redinger, C. A., Res. Engr., Sou. Ry., Selma, N. C.
Reid, R. H., Supvr. Bridges, N. Y. C. R. R., Cleveland, Ohio.
Replogle, J. S., For. B. & B., Sou. Pac. Co., Oakland, Cal.
Rettinghouse, H., Ch. Engr., C. St. P. M. & O. Ry., St. Paul, Minn.
Reynolds, A. W., Mast. Carp., P. R. R., Jersey City, N. J.
Reynolds, J. V., For. B. & B., St. L. I. M. & S. Ry., McGehee, Ark.
Rice, A. P., Roadmaster, C. N. & L. R. R., Columbia, S. C.
Rich, B. D., Painter For., Sou. Pac. Co., Stockton, Cal.
Richards, G. T., Supt. B. & B. Shops, C. M. & St. P. Ry., Tomah, Wis.
Richardson, R. W., Div. Engr., C. & N. W. Ry., Sioux City, Ia.
Ridgway, Arthur, Asst. Ch. Engr., D. & R. G. R. R., Denver, Colo.
Riney, M.. Gen'l For. B. and B.. C. & N. W. Ry., Baraboo, Wis.
***Rintoul, D. T.**, Gen'l For. B. and B., Sou. Pac. Co., Bakersfield, Cal.
Robertson, A. A., Supr. B. and B., N. W. Pac. Ry., San Rafael, Cal.

Robinson, A. W., Div. Engr., O. S. L. R. R., Pocatello, Idaho.
Robinson, J. S., Div. Engr., C. & N. W. Ry., Chicago.
Robinson, John, Supvr. B. and B., P. M. R. R., Grand Rapids, Mich.
Robinson, R. B., Engr. M. of W., O. S. L. R. R., Pocatello, Idaho.
Rodman, G. A., Supt. B. & B., N. Y. N. H. & H. R. R., New Haven, Conn.
Rogers, W. A., Civil Engineer, 37 W. Van Buren St., Chicago.
Rohbock, W. L., Ch. Engr., W. & L. E. R. R., Cleveland, Ohio.
Rohr, E. J., Asst. Br. Supv., C. & O. Ry., Brighton Sta., Cincinnati, O.
Roper, D. L., For. B. & B., St. L. I. M. & S. Ry., Monroe, La.
Rose, Norman, Supvr. B. and B., Sou. Pac. Co., Portland, Ore.
Rose, W. M., For. Water Service, Sou. Pac. Co., Sacramento, Cal.
Ross, William, Chief Carp., C. M. & St. P. Ry., Millbank, S. D.
Rcunseville, D., Eng. Maint., C. & N. W. Ry., Chicago.
Roy, C. M., Gen. Bridge For., L. & N. R. R., Birmingham, Ala.
Ruge, Aug., Supvr. B. & B., C. St. P. M. & O. Ry., Mankato, Minn.
Runyon, C. C., For. B. & B., St. L. I. M. & S. Ry., Gorham, Ill.
Rykenboer, E. J., Supvr. Bldgs., N. Y. C. R. R., Rochester, N. Y.

Sampson, G. T., Asst. Engr., N. Y. N. H. & H. R. R., Boston.
Sattley, R. C., Valuation Engr., C. R. I. & P. Ry., Chicago.
Schall, F. E., Bridge Engr., L. V. R. R., So. Bethlehem, Pa.
Scheetz, F. B., Dept. Valuation, I. C. C., Kansas City. Mo.
Schoolcraft, C. S., For. Brgs., C. Vt. R., Farnham, Que.
Schuessler, W. B., Supvr. B. & B., N Y N H & H R. R., Waterbury, Conn.
Scott, Chas., Supvr. B. & B., B. R. & P. Ry., E. Salamanca, N. Y.
Scribner, C. J., Bldg. Inspr., **C. B. & Q. Ry., Chicago.**
Searls, Niles, Gen. Fire Inspector, Sou. Pac. Co., San Francisco, Cal.
Secord, Fred, For. B. & B., Sou. Pac. Co., Sacramento, Cal.
Sedmoradsky, C., For. B. & B., C. St. P. M. & O. Ry., Worthington, Minn.
Sedwell, G. W., Tunnel For., Sou. Pac. Co., Bakersfield. Cal.
Seeley, L. T., Gen. For. B. & B., A. T. & S. F. Ry., Needles, Cal.
Seely, S. A., Asst. Engr., N. Y. C. R. R., Utica, N. Y.
Self, E. P., Supv. Bldgs., L. I. R. R., Jamaica, N. Y.
Sellew, W. H., Valuation Dept., M. C. R. R., Detroit, Mich.
Settle, T. H., Gen. For. B. & B., S. P. Co., Los Angeles, Cal.
Shane, A., Box 71, Indianapolis, Ind.
Shanklin, F. E., Gen. For., C. & N. W. Ry., Belle Plaine, Iowa.
Sharp, J. S., Res. Engr., N. O. & N. E. R. R., New Orleans, La.
Sharpe, D. W., Supv. B. & B., N. Y. N. H. & H. R. R., New Haven, Conn.
Sharpe, T. E., Supvr. B. and B., **Sou. Ry., Greenville, S. C.**
Shean, J. R., Ptr. For., Pac. Elec. Ry., Los Angeles, Cal.
Sheldon, J. B., Supvr. B. & B., N. Y. N. H. & H. R. R., Providence, R. I.
Sheley, Wm., Asst. Supvr. B. and B., L. & N. R. R., Evansville, Ind.
Shields, A. C., Div. Engr., C. R. I. & P. Ry., Trenton, Mo.
Shifflet, Parker, For. Br. Erec., O. S. L. R. R., Pocatello, Idaho.
Shope, D. A., Fresno, Cal.
Shropshire, W., Supvr. of B. and B., Y. & M. V. R. R., Greenville, Miss.
Sibley, C. A., Engr. & Contr., 902 Chapel St., New Haven, Conn.
Siefer, F. M., Div. Engr., Sou. Pac. Co., Sacramento, Cal.
Simmons, I. L., Br. Engr., C. R. I. & P. Ry., Chicago.
Sinclair, E. L., Asst. Engr., C. M. & St. P. Ry., Marion, Iowa.
Sisson, F. P., Asst. Engr., G. T. Ry., Detroit, Mich.
Skeoch, Jas., Gen. For. B. & B., D. L. & W. R. R., Dunmore. Pa.
Slabotsky, H., Asst. Engr., M. L. & T. R. R. & S. S. Co., Lafayette, La
Smetters, S. T., Asst. Br. Engr., Sanitary Dist. of Chicago, Chicago, Ill.
Smith, A. W., Bridge Dept. C. N. Ry., Winnipeg, Manitoba.
Smith, C. E., Consulting Engr., 2075 Ry. Exch. Bldg., St. Louis, Mo.
Smith, C. U., Asst. Engr., C. M. & St. P. Ry., Milwaukee, Wis.
Smith, C. W., Asst. Supvr. B. & B., Sou. Pac. Co., Portland, Ore
Smith, E. U., Ch. Dft., The Austin Co., 1026 Bulletin Bldg., Philada., Pa.
Smith, E. W., Architect Val., M. C. R. R., Detroit, Mich.

Smith, L. D., C. E., Room 18, Ferry Bldg., San Francisco.
Smith, M. A., Gen. For. B. & B., I. C. R. R., New Orleans, La.
Smith, R. W., Gen. For. B. & B., T. & B. V. Ry., Teague, Tex.
Smith, Wm., For. W. S., St. L. I. M. & S. Ry., McGehee, Ark.
Snow, J. P., 1120 Kimball Bldg., Boston, Mass.
Snyder, A. M., Supv. B. & B., L. & N. E. R. R., Pen Argyl, Pa.
Soisson, J. L., Gen'l For. B. and B., N. Y. C. R. R., Norwalk, Ohio.
Sorensen, Wm., For. B. & B., O. S. L. R. R., Brigham, Utah.
Sorrells, O. M., Asst. Div. Engr., N. C. & St. L. Ry., Atlanta, Ga.
Spalding, Lawrence, Supv. Struct., B. & L. E. R. R., Greenville, Pa.
Spell, W. A., Ch. Draftsman, A. B. & A. Ry., Atlanta, Ga.
Spencer, Jos., For. B. & B., G. T. Ry., Stratford, Ont.
Spencer, Wm., C. & N. W. Ry., Norfolk, Neb.
Stamler, H., Supvr. B. & B., L. & N. R. R., Paris, Ky.
Stannard, James, 1602 Broadway, Kansas City, Mo.
Staten, J. M., Gen'l Bridge Insp., C. & O. Ry., Richmond, Va.
Steadham, J. J., Supv. B. & B., N. O. & N. E. R. R., New Orleans, La.
Steffens, W. F., Special Engr., N. Y. C. Lines, New York City.
Sterling, W. M., Ch. Clerk, C. & N. W. Ry., Chicago.
Stern, I. F., C. E., Old Colony Bldg., Chicago.
Stevens, A. R., For. B. and B., O. S. L. R. R., Pocatello, Idaho.
Stewart, G. H., Master Mason, B. R. & P. Ry., Salamanca, N. Y.
Stewart, John, Gen. For. B. & B., C. St. P. M. & O. Ry., Spooner, Wis.
Stewart, W A., For. Brgs., C. Vt. R. R., New London, Conn.
Stewart, W. G., Supvr. B. and B., L. & N. R. R., Nashville, Tenn.
Stiver, C. C., Scale Insp., B. & O. R. R., Garrett, Ind.
Stone, L. W., Supvr. B. & B., N. Y. C. R. R., Oswego, N. Y.
Storck, E. G., Mast. Carp., P. & R. Ry., Philadelphia, Pa.
Strothers, R. R., Asst. Engr., C. & St. P. M. & O. Ry., St. Paul, Minn.
Strouse, W. F., Asst. Engr., B. & O. R. R., 400 Forest Road, Baltimore.
Stuart, H. B., Struct. Engr., G. T. Ry., Montreal, Que.
Stuart, T. J., Supvr. B. and B., W. Pac. Ry., Elko, Nev.
Sullivan, William, Care Div. Supt., Mo. Pac. Ry., Kansas City, Mo.
Suter, O. M., Supvr. B. & B., I. C. R. R., Chicago.
Swain, G. F., Prof. C. E., Harvard University, Cambridge, Mass.
Swan, L. W., Supvr. B. and B., L. V. R. R., Easton, Pa.
Swartz, A., Vice Pres., Toledo & Western R. R., Sylvania, Ohio.
Swartz, H. C., Master B. & B., G. T. R., St. Thomas, Ont.
Swartz, W. G., Asst. Engr. Const., G. T. R., Campbellford, Ont.
Sweeney, Wm., For. B and B., C. & N. W. Ry., Green Bay, Wis.
Swenson, A. M., (C. F. Massey Co.,) Peoples Gas Bldg., Chicago, Ill.
Swenson, P., Supt. B. and B., M. St. P. & S. Ste. M. Ry., Minneapolis.
Sydell, A. C., Chief Draftsman, C. B. & Q. R. R., Chicago, Ill.

Talbott, J. L., Gen'l For. B. and B., A. T. & S. F. Ry., Pueblo, Col.
Tanner, F. W., Insp. M. of W., Mo. Pac. Ry., St. Louis, Mo.
Tanner, S. C., Mast. Carp., B. & O. R. R., Baltimore, Md.
Tattershall, E. R., Supvr. B. & B., N. Y. C. R. R., Malone, N. Y.
Taylor, D. B., Mast. Carp., B. & O. R. R., Garrett, Ind.
Taylor, F. A., Mast. Carp., B. & O. R. R., Cumberland, Md.
Taylor, Herbert, Supvr. B. and B., D. & R. G. R. R., Alamosa, Colo.
Taylor, J. J., Supt. B. & B., K. C. S. Ry., Texarkana, Tex.
Teaford, J. B., Supvr. B. & B., Sou. Ry., Louisville, Ky.
Templin, E. E., For. Carp., P. & R. Ry., Pottsville, Pa.
Tewksbury, D. G., Supvr. B. & B., St. L. I. M. & S. Ry., Gorham, Ill.
Thomas, M. E., Div. Engr., C. & N. W. Ry., Boone, Iowa.
Thomas, T. E., Mast. Carp., B. & O. R. R., Philadelphia, Pa.
Thompson, C., Supt. Newkirk & Powers Const. Co., Joliet, Ill.
Thompson, C. S., Supt. B. and B., D. & R. G. R. R., Denver.
Thompson, E. E., G. F. B. & B., A. E. R. R., Phœnix, Ariz.
Thompson, F. J., Asst. Supv. B. & B., F. E. C. Ry., St. Augustine, Fla.

Thompson, F. L., Asst. Ch. Engr., I. C. R. R., Chicago.
Thompson, H. C., Div. Engr., N. Y. C. R. R., Weehawken, N. J.
Thomson, J. L., Gen. Insp. B. & B., D. & R. G. R. R., Salt Lake City.
Thorn, J. O., C. B. & Q. R. R., Beardstown, Ill.
Thorn, S. B., Div. For. Bldgs., M. C. R. R., Bay City, Mich.
Tichbourne, W. H., Supvr. B. & B., G. T. Ry., London, Ont.
Todd, R. E., Asst. Engr., C. & N. W. Ry., Madison, Wis.
Toohey, J. E., Gen'l For. B. and B., P. M. R. R., Grand Rapids, Mich.
Trapnell, Wm., Supt. C. & C. Ry., Elkins, W. Va.
Tratman, E. E. R., Ed. Eng. News-Record, Old Colony Bldg., Chicago, Ill.
Travis, J. E., Pinehurst, Wash.
Tretheway, Thos., For. B. & B., Sou. Pac. Co., Stockton, Cal.
Turnbull, T. B., Supt. B. & B., A. A. R. R., Owosso, Mich.
Turner, W. F., Asst. Div. Engr., Sou. Pac. Co., Ogden, Utah.
Tyers, W. J., Supvr. B. & B., G. T. Ry., Belleville, Ont.

Ullery, O. E., Asst. Engr., C. & N. W. Ry., Sioux City, Ia.
Urbutt, C. F., Engr. Track Elev., C. M. & St. P. Ry., Chicago, Ill.

Vandercook, Wesley, Ch. Engr., S. A. & S. W. Ry. Sys., Lake Charles, La.
Vance, W. H., Engr. M. of W., St. L. S. W. Ry., Tyler, Tex.
Vatter, E. J., For. P. & W., B. & M. R. R., Salem, Mass.
Vincent, E. J., For. B. & B., Sou. Pac. Co., Los Angeles.
Vollmer, C. G., Ch. Carp., C. M. & St. P. Ry., Elk Point, So. Dak.
Von Schrenk, Hermann, Cons. Timber Engr., 4276 Fladd Ave., St. Louis.

Wackerle, L. J., Supvr. B. & B., Mo. Pac. Ry., Osawatomie, Kans.
Wagner, R., Pile Driver For., C. R. I. & P. Ry., Little Rock, Ark.
Waits, A. L., For. B. and B., St. L. I. M. & S. Ry., St. Louis, Mo.
Walker, I. O., Div. Engr., W. & A. R. R., Atlanta, Ga.
Wallenfelsz, J., Mast. Carp., Pa. Lines W., Cambridge, O.
Warcup, C. F., For. W. S., G. T. R., St. Thomas, Ont.
Watson, P. N., Supvr. B. and B., Maine Central R. R., Brunswick, Me.
***Webb, Geo. H.,** Ch. Engr., M. C. R. R., Detroit, Mich.
Wehlen, Charles, Br. Inspr., L. I. R. R., Jamaica, N. Y.
Weir, C. F., Supvr. B. & B., P. M. R. R., St. Thomas, Ont.
Weise, F. E., Chief Clerk, Eng. Dept., C. M. & St. P. Ry., Chicago.
Weldon, A., For. B. & B., Sou. Pac. Co., Los Angeles, Cal.
Welker, G. W., Supvr. B. and B., Southern Ry., Alexandria, Va.
Wells, C. R., Br. For., Sou. Pac. Co., Sacramento, Cal.
Wells, D. T., Genl. For. B. & B., O. S. L. R. R., Salt Lake City, Utah.
Wells, L. N., Div. For., B. & M. R. R., Woodsville, N. H.
Wenner, E. R., Supvr. B. and B., L. V. R. R., Ashley, Pa.
Wheaton, L. H., Div. Engr., Intercolonial Ry., Dartmouth, N. S.
Wherren, F. M., Div. For. B. & B., B. & M. R. R., Salem, Mass.
White, F. W., Supvr. B. & B., L. V. R. R., Sayre, Pa.
White, J. B., For. W. S., **C. & N. W. Ry.,** Boone, Ia.
Whitmee, G. Y., For. W. S., P. M. R. R., Grand Rapids, Mich.
Whitney, W. C., Sen. Archt., I. C. C., 1907-15th St. N. W., Wash., D. C.
Wicks, Warren, Gen'l For., L. I. R. R., Amityville, N. Y.
Wilkinson, J. M., Supvr. B. and B., C. N. R. R., Van Wert, Ohio.
Wilkinson, W. H., Bridge Insp., Erie R. R., Elmira, N. Y.
Williams, J. C., Supvr., Georgia R. R., Decatur, Ga.
Williams, M. R., Gen. For. B. & B., A. T. & S. F. Ry., Las Vegas, N. M.
Wilson, E. E., Supv. Brgs., N Y C R R, New York City (81 E. 125th St.).
Wilson, J., Supvr. B. & B., G. T. Ry., Hamilton, Ont.
Wilson, M. M. Div. Br. Inspr., Sou. Pac. Co., Los Angeles
Wilson, W. W., Div. Engr., G. C. & S. F. Ry., Galveston, Tex.
Winter, A. E., C. E., 257 Cathedral Pl., St. Paul, Minn.
Winter, J. L., Mast. Carp., S. A. L. Ry., Waldo, Fla.
Wise, E. F., 207 Clay St., Waterloo, Iowa.
Wishart, J. J., Supvr. B. & B., N. Y. N. H. & H. R. R., Boston, Mass.

Witt, C. C., Dist. Engr., I. C. C., 1020 McGee St., Kansas City, Mo.
Wolf, A. A., Dist. Carp., C. M. & St. P. Ry., Milwaukee, Wis.
Womeldorf, C. F., Asst. Engr., C. & N. W. Ry., Chicago, Ill.
Wood, J. P., Supvr. B. & B., P. M. R. R., Saginaw, Mich
Wood, J. W., Gen'l For. B. and B., A. T. & S. F. Ry., San Bernardino, Cal.
Wood, W. E., Dist. Engr., C. M. & St. P. Ry., Chicago.
Wright, C. W., Mast. Carp., L. I. R. R., Jamaica, N. Y.
Wright, G. A., Gen. For. B. & B., Ill. Trac. Sys., Decatur, Ill.

Yappen, Adolph, Dist. Carp., C. M. & St. P. Ry., Chicago.
Yates, J. P., Gen. For. B. & B., N. O. T. & M. R. R., DeQuincy, La.
Yereance, W. B., Cons. Engr., 128 Broadway, New York City.
Young, R. C., Chief Engr., L. S. & I. Ry., Marquette, Mich.

Zenor, D., For. B. & B., L. & A. Ry., Stamps, Ark.
Zinsmeister, E. C., Mast. Carp., B. & O. R. R., Newark, O.
Zook, D. C., Mast. Carp., Pa. Lines W. of Pitts., Ft. Wayne, Ind.
Zorn, J. F., For. B. & B., Pac. Elec. Ry., Los Angeles, Cal.

Total number of members 709.

LIFE MEMBERS

Austin, C. P., 107 Park St., Medford, Mass.
Bailey, S. D., Mich. Cent. R. R., Detroit, Mich.
Carmichael, Wm., St. J. & G. I. R. R., St. Joseph, Mo.
Carpenter, J. T., 345 No. Bartlett St., Medford, Ore.
Cummin, Jos. H., Bay Shore, N. Y.
Findley, A., 929 Wash. Ave., Portland, Me.
Gooch, C. W., 1325 W. 9th St., Des Moines, Ia.
Green, E. H. R., Texas Midland R. R., Terrell, Tex.
Hanks, G. E., E. Saginaw, Mich.
Hubbard, A. B., 32 Banks St., West Somerville, Mass.
Killam, A. E., Moncton, N. B.
Loughery, E., Gen. For. B. & B., T. & P. Ry., Dallas, Tex.
Lydston, W. A., Swampscott, Mass.
Mackenzie, W. B., C. E., Moncton, N. B.
McLean, Neil, Mast. Carp., Erie R. R., Huntington, Ind.
Mountain, G. A., Ch. Engr., Ry. Com. of Canada, Ottawa, Ont.
Noon, W. M., Miami, Fla.
Parks, Jas., U. P. R. R., Denver, Colo.
Porter, L. H., Box 35, Andover, Conn.
Ross, Wm., C. M. & St. P. Ry., Millbank, So. Dak.
Shane, A., Box 71, Indianapolis, Ind.
Snow, J. P., 1120 Kimball Bldg., Boston, Mass.
Stannard, Jas., 1602 Broadway, Kansas City, Mo.
Tanner, Frank, Mo. Pac. Ry., St. Louis, Mo.
Thorn, J. O., C. B. & Q. R. R., Beardstown, Ill.
Wise, E. F., 207 Clay St., Waterloo, Ia.

DECEASED MEMBERS

Aldrich, G.
Amos, A.,
Andrews, O. H.
Berg, Walter G.
Bishop, Geo. J.
Biss, C. H.
Blair, J. A.
Bowman, A. L.
Brady, James
Cahill, M. F.
Carr, Charles
Causey, T. A.
Clark, W. M.
Cleaveland, H. D.
Connolly, C. G.
Costolo, J. A.
Crane, Henry
DeMars, James
Dunlap, H.
Edinger, F. S.
Ewart, John
Fletcher, H. W.
Forbes, Jno.
Foreman, John
Fuller, C. E.
Gaskin, W.
Gilbert, J. D.
Gilchrist, E. M.
Graham, T. B.
Hall, H. M.
Harwig, W. E.
Heflin, R. L.
Henson, H. M.
Hinman, G. W.
Holmes, H. E.
Hubley, John
Humphreys, Thos.
Isadell, L. S.
Johnson, J. E.
Keen, Wm. H.
Lantry, J. F.
Large, C. M.
Larson, G.
Lovett, J. W.
Mallard, C. C.
Markley, Abel S.
McCormack, J. W.
McGehee, G. W.
McIlwain, J. T.
McIntyre, Jas.
McKee, R. J.
McMahon, J.
Mellor, W. T.
Millner, S. S.
Mitchell, J. B.
Mitchell, W. R.
Morgan, J. W
Morgan, T. H.
Morrill, H. P
Patterson, S. F.
Peck, R. M.
Perry, W. W.
Phillips, H. W.
Powell, W. T.
Reid, G. M.
Renton, Wm.
Reynolds, E. F.
Robertson, Daniel
Schaffer, J.
Schenck, W. S.
Schwartz, J. C.
Soles, G. H.
Spafford, L. K.
Spangler, J. A.
Spaulding, E. C.
Spencer, C. F.
Taylor, J. W.
Thompson, N. W
Tozzer, Wm. S.
Trautman, J. J.
Travis, O. J.
Vandegrift, C. W.
Van Der Hoek, J.
Vaughan, Jas.
Wallace, J. F.
Walden, W. D.
Welch, E. T.
Wells, J. M.
Wood, W. B.
Worden, C. G.

MEMBERSHIP AND MILEAGE OF RAILWAYS REPRESENTED.

Name of Road and Membership.	Members.	Mileage.
Alabama & Vicksburg Ry.,	1	313
(Vicksburg, Shreveport & Pac. Ry.)		
E. L. Loftin, Vicksburg, Miss.		
Algoma Central & Hudson Bay Ry.	1	332
R. S. McCormick, Sault Ste. Marie, Ont.		
Ann Arbor R. R.,	1	292
T. B. Turnbull, Owosso, Mich.		
Arizona Eastern R. R.	1	373
E. E. Thompson, Phœnix, Ariz.		
Atchison, Topeka & Santa Fé Ry.,	5	5,968
Julius Froese, La Junta, Colo.		
A. J. James, Topeka, Kans.		
E. McCann, Wellington, Kans.		
John L. Talbott, Pueblo, Colo.		
M. R. Williams, Las Vegas, N. M.		
Atchison, Topeka & Santa Fé Ry. (Coast Lines)	6	2,053
E. E. Ball, Fresno, Cal.		
J. H. Grover, Fresno, Cal.		
W. H. Oliver, San Bernardino, Cal.		
J. F. Parker, San Bernardino, Cal.		
L. T. Seeley, Needles, Cal.		
J. W. Wood, Fresno, Cal.		
Atlanta & West Point R. R. and W. Ry. of Ala.	1	225
O. T. Nelson, Atlanta, Ga.		
Atlanta, Birmingham & Atlantic Ry.,	1	638
W. A. Spell, Atlanta. Ga.		
Atlantic Coast Line R. R.	2	4,744
M. E. Nelson, Wilmington, N. C.		
J. W. Salisbury, Port Tampa, Fla.		
Baltimore & Ohio R. R. (System),	22	6,627
G. W. Andrews, Baltimore, Md.		
S. H. Blowers, Columbus, O.		
W. S. Bouton, Baltimore, Md.		
Z. T. Brantner, Martinsburg, W. Va.		
H. R. Bricker, Baltimore, Md.		
G. S. Crites, Cincinnati, O.		
Chas. Esping, Chicago, Ill.		
R. F. Farlow, Chillicothe, O		

Name of Road and Membership.	Members.	Mileage.
Baltimore & Ohio R. R. (System). Continued.		
W. T. Hopke, Grafton, W. Va.		
A. T. Humbert, New Castle Jct., Pa.		
L. H. Douglas, Cleveland, O.		
M. A. Long, Baltimore, Md.		
B. S. Mace, Baltimore, Md.		
E. G. Moore, Flatwoods, W. Va.		
J. O. Potts, Baltimore, Md.		
C. C. Stiver, Garrett, Ind.		
W. F. Strouse, Baltimore, Md.		
S. C. Tanner, Baltimore, Md.		
D. B. Taylor, Garrett, Ind.		
F. A. Taylor, Cumberland, Md.		
T. E. Thomas, Wilmington, Del.		
E. C. Zinsmeister, Newark, O.		
Bangor & Aroostook R. R.	2	628
W. E. Alexander, Houlton, Me.		
M. Burpee, Houlton, Me.		
Bessemer & Lake Erie R. R.,	2	210
H. H. Harman, Greenville, Pa.		
L. Spalding, Greenville, Pa.		
Boston & Maine R. R.,	24	2,302
E. M. McCabe, Pittsfield, Mass.		
Boston & Maine R. R.,	23	2,302
Cyrus P. Austin (retired), Medford, Mass.		
L. M. Blake, St. Johnsbury, Vt.		
J. E. Buckley, Nashua, N. H.		
J. P. Canty, Fitchburg, Mass.		
S. P. Coffin, Boston, Mass.		
S. E. Dufort, Lowell, Mass.		
J. H. Fullerton, Woodsville, N. H.		
A. I. Gauthier, Concord, N. H.		
B. W. Guppy, Boston, Mass.		
Andrew B. Hubbard (retired), W. Somerville, Mass.		
Pusey Jones, Boston, Mass.		
F. J. Leavitt, Sanbornville, N. H.		
William A. Lydston (retired), Swampscott, Mass.		
John Marsh, Lawrence, Mass.		
H. C. McNaughton, Concord, N. H.		
Albert Mountfort, Nashua, N. H.		
A. A. Page, Wilmington, Mass.		
E. F. Palmer, Salem, Mass.		
B. F. Pickering, Salem, Mass.		
F. M. Pickering, Salem, Mass.		
E. B. Piper, Concord, N. H.		
E. J. Vatter, Salem, Mass.		
L. N. Wells, Woodsville, N. H.		
F. M. Wherren, Salem, Mass.		
Buffalo, Rochester & Pittsburgh Ry.	4	586
F. A. Benz, E. Salamanca, N. Y.		
E. W. Fair, Du Bois, Pa.		
Chas. Scott, E. Salamanca, N. Y.		
G. H. Stewart, E. Salamanca, N. Y.		
Canadian Northern Ry. System	2	9,295
J. A. Crawford, Saskatoon, Sask.		
A. W. Smith, Winnipeg, Manitoba.		

Name of Road and Membership.	Members.	Mileage.
Canadian Pacific Ry.	2	12,917
Frank Lee, Montreal, Que.		
D. A. McRae, Lethbridge, Alberta.		
Carolina & Northwestern Ry.	1	133
J. W. Fletcher, Chester, S. C.		
Central of Georgia Ry.	2	1,924
J. M. Fitzgerald, Macon, Ga.		
H. C. McKee, Macon, Ga.		
Central Vermont Ry.,	6	536
G. M. Cota, St. Albans, Vt.		
C. Donaldson, St. Albans, Vt.		
C. F. Flint, St. Albans, Vt.		
C. R. Lyman, Waterbury, Vt.		
C. H. Schoolcraft, Farnham, Que.		
W. A. Stewart, New London, Conn.		
Chesapeake & Ohio Ry.,	6	2,374
T. H. Allen, Hinton, W. Va.		
A. C. Copland, Richmond, Va.		
F. M. Griffith, Covington, Ky.		
C. E. Powell, Hinton, W. Va.		
E. J. Rohr, Cincinnati, O.		
J. M. Staten, Richmond, Va.		
Chicago & Eastern Illinois R. R.	1	1,282
A. S. Markley, Danville, Ill.		
Chicago & North Western Ry.,	44	8,102
L. J. Anderson, Escanaba, Mich.		
C. F. Bach, Belle Plaine, Ia.		
H. Bender, Eagle Grove, Ia.		
F. L. Burrell, Fremont, Neb.		
F. M. Case, Belle Plaine, Ia.		
John Cronin, Winona, Minn.		
O. F. Dalstrom, Chicago, Ill.		
T. H. Durfee, Huron, S. D.		
W. H. Finley, Chicago, Ill.		
M. J. Flynn, Chicago, Ill.		
G. W. Hand, Chicago, Ill.		
H. Heiszenbuttel, Norfolk, Neb.		
C. Herrig, Wall Lake, Ia.		
John Hunciker, Chicago, Ill.		
T. J. Irving, Boone, Ia.		
J. W. Irwin, Chadron, Neb.		
W. J. Jackson, Winona, Minn.		
Lee Jutton, Chicago, Ill.		
C. F. King, Omaha, Neb.		
B. R. Kulp, Benld, Ill.		
C. A. Lichty, Chicago, Ill.		
J. A. Lorch, Chicago, Ill.		
George Loughnane, Escanaba, Mich.		
C. A. Marcy, Chicago, Ill.		
J. Mellgren, Eagle Grove, Ia.		
W. F. Meyers, Boone, Iowa.		
C. E. Miller, Chicago, Ill.		
J. W. Miller, Chicago, Ill.		
W. H. Mulcahy, Adams, Wis.		
A. K. Potter, Antigo, Wis.		
J. A. S. Redfield, Fond du Lac, Wis.		

Name of Road and Membership.	Members.	Mileage.
Chicago & North Western Ry. Continued.		
R. W. Richardson, Sioux City, Ia.		
M. Riney, Baraboo, Wis.		
J. S. Robinson, Chicago, Ill.		
D. Rounseville, Chicago, Ill.		
F. E. Shanklin, Belle Plaine, Ia.		
Wm. Spencer, Norfolk, Nebr.		
W. M. Sterling, Chicago, Ill.		
W. M. Sweeney, Green Bay, Wis.		
M. E. Thomas, Boone, Ia.		
R. E. Todd, Madison, Wis.		
O. E. Ullery, Sioux City, Ia.		
T. B. White, Boone, Ia.		
C. F. Womeldorf, Chicago, Ill.		
Chicago, Burlington & Quincy R. R. Co., ...	6	9,366
W. E. Elder, Burlington, Ia.		
W. Hurst, Chicago, Ill.		
W. T. Krausch, Chicago, Ill.		
C. J. Scribner, Chicago.		
A. C. Sydell, Chicago, Ill.		
J. O. Thorn, Beardstown, Ill.		
Chicago Great Western R. R.,..........................	4	1,496
W. L. Derr, Clarion, Ia.		
H. H. Eggleston, Des Moines, Ia.		
H. A. Elwell, Clarion, Ia.		
Nels Johnson, St. Charles, Ill.		
Chicago, Indianapolis & Louisville Ry.,..................	1	654
J. M. Caldwell, Lafayette, Ind.		
Chicago, Milwaukee & St. Paul Ry., ...	28	10,667
E. J. Auge, Wells, Minn.		
A. J. Buck, Tacoma, Wash.		
E. E. Clothier, Mobridge, S. D.		
Edw. Collings, Perry, Ia.		
H. R. Drum, Mitchell, S. D.		
W. E. Duckett, Minneapolis, Minn.		
Chas. Gradt, Savanna, Ill.		
L. D. Hadwen, Chicago, Ill.		
F. E. King, Minneapolis, Minn.		
N. H. LaFountain, Chicago, Ill.		
W. R. Lanning, St. Maries, Idaho.		
C. F. Loweth, Chicago, Ill.		
T. E. McFadden, Cedar Falls, Wash.		
Edw. McGuire, Marion, Ia.		
E. S. Meloy, Chicago.		
R. J. Middleton, Chicago, Ill.		
Edw. Murray, Miles City, Mont.		
J. F. Pinson, Seattle, Wash.		
G. T. Richards, Tomah, Wis.		
William Ross, Milbank, S. D.		
E. L. Sinclair, Marion, Ia.		
C. U. Smith, Milwaukee, Wis.		
C. F. Urbutt, Chicago, Ill.		
C. G. Vollmer, Elk Point, S. D.		
Fred E. Weise, Chicago, Ill.		
A. A. Wolf, Milwaukee, Wis.		
William E. Wood, Chicago, Ill.		
A. Yappen, Chicago, Ill.		

Name of Road and Membership.	Members.	Mileage
Chicago, Rock Island & Pacific Ry.,	14	7,657
McClellan Bishop, El Reno, Okla.		
G. E. Brooks, Rock Island, Ill.		
J. P. Copp, Haileyville, Okla.		
S. T. Corey, Chicago, Ill.		
C. H. Eggers, Little Rock, Ark.		
A. T. Hawk, Chicago, Ill.		
J. L. Hayes, Rock Island, Ill.		
E. F. Manson, Manly, Ia.		
S. L. McClanahan, Herington, Kans.		
M. D. Miller, Chicago, Ill.		
R. C. Sattley, Chicago.		
A. C. Shields, Trenton, Mo.		
I. L. Simmons, Chicago, Ill.		
R. Wagner, Little Rock, Ark.		
Chicago, St. Paul, Minneapolis & Omaha Ry.,	11	1,750
J. G. Bock, St. Paul, Minn.		
A. F. Gilman, St. Paul, Minn.		
J. F. Glasgow, Worthington, Minn.		
Chas. Mines, Emerson, Neb.		
J. D. Moen, St. Paul, Minn.		
A. G. Rask, Altoona, Wis.		
H. Rettinghouse, St. Paul, Minn.		
Aug. Ruge, Mankato, Minn.		
Chas. Sedmoradsky, Worthington, Minn.		
John Stewart, Spooner, Wis.		
R. R. Strothers, St. Paul, Minn.		
Chicago, Terre Haute & Southeastern Ry.	2	351
J. Dupree, Crete, Ill.		
J. O. Jewell, Terre Haute, Ind.		
Cincinnati, Hamilton & Dayton Ry.,	2	132
R. C. Henderson, Dayton, O.		
A. D. McCallum, Hamilton, O.		
Cincinnati, New Orleans & Texas Pacific Ry.	2	338
F. J. Conn, Lexington, Ky.		
L. A. Cowsert, Danville, Ky.		
Cincinnati Northern R. R.	1	236
J. M. Wilkinson, Van Wert, O.		
Coal & Coke Ry.,	1	197
Wm. Trapnell, Elkins, W. Va.		
Colorado & Southern Ry.,	4	1,089
R. W. Beeson, Trinidad, Colo.		
C. W. Fellows, Denver, Colo.		
Harry James, Denver, Colo.		
A. W. Pauba, Denver, Colo.		
Colorado Midland Ry.	1	338
J. Guretzky, Colorado City, Colo.		
Columbia, Newberry & Laurens R. R.	1	75
A. P. Rice, Columbia, S. C.		
Concho, San Saba & Llano Valley R. R.	1	61
K. S. Hull, Temple, Tex.		

Name of Road and Membership.	Members.	Mileage
Delaware & Hudson Co.,	1	909
N. C. Ailes, Albany, N. Y.		
Delaware, Lackawanna & Western R. R.,	4	981
E. J. Barry, Hoboken, N. J.		
G. E. Boyd, Buffalo, N. Y.		
Albert Fink, Buffalo, N. Y.		
Jas. Skeoch, Dunmore, Pa.		
Denver & Rio Grande R. R.,	4	2,577
A. Ridgway, Denver, Colo.		
H. Taylor, Alamosa, Colo.		
C. S. Thompson, Denver, Colo.		
J. L. Thomson, Salt Lake City.		
Detroit & Mackinac Ry.	1	434
John Owen, East Tawas, Mich.		
Duluth & Iron Range R. R.,	3	197
W. A. Clark, Duluth, Minn.		
O. H. Dickerson, Duluth, Minn.		
B. T. McIver, Two Harbors, Minn.		
Duluth, Missabe & Northern Ry.,	4	356
F. C. Baluss, Duluth, Minn.		
F. N. Graham, Duluth, Minn.		
W. A. McGonagle, Duluth, Minn.		
G. K. Nuss, Proctor, Minn.		
Duluth, South Shore & Atlantic Ry.	1	601
E. R. Lewis, Duluth, Minn.		
Elgin, Joliet & Eastern Ry.	3	770
W. B. Hotson, Joliet, Ill.		
G. H. Jennings, Joliet, Ill.		
A. Montzheimer, Joliet, Ill.		
Erie R. R.,	9	2,257
O. F. Barnes, Jersey City, N. J.		
W. O. Eggleston, Huntington, Ind.		
E. F. Gardner, Buffalo, N. Y.		
A. W. Harlow, Huntington, Ind.		
A. J. Horth, Meadville, Pa.		
F. A. Knapp, Jersey City, N. J.		
Neil McLean. Huntington, Ind.		
Roy Pierce, Salamanca, N. Y.		
W. H. Wilkinson, Elmira, N. Y.		
Florida East Coast Ry.	2	746
E. K. Barrett, St. Augustine, Fla.		
F. J. Thompson, St. Augustine, Fla.		
Fort Smith & Western R. R.	1	217
B. F. Beckman, Ft. Smith, Ark.		
Fort Worth & Denver City Ry.	1	454
J. M. Mann, Ft. Worth, Tex.		
Georgia R. R.,	1	307
J. C. Williams, Decatur, Ga.		
Grand Rapids & Indiana Ry.	2	592
H. M. Large, Ft. Wayne, Ind.		
W. S. McKeel, Grand Rapids, Mich.		

Name of Road and Membership.	Members.	Mileage.
Grand Trunk Ry. System,	16	4,735
W. Cayley, Stratford, Ont.		
J. B. Gaut, Chicago, Ill.		
J. Henderson, St. Thomas, Ont.		
J. Innes, Hamilton, Ont.		
J. H. Johnston, Montreal, Que.		
G. C. McCue, Ottawa, Ont.		
George A. Mitchell, Toronto, Ont.		
F. P. Sisson, Detroit, Mich.		
Jos. Spencer, Stratford, Ont.		
H. B. Stuart, Montreal, Que.		
H. C. Swartz, St. Thomas, Ont.		
W. G. Swartz, Campbellford, Ont.		
W. H. Tichbourne, London, Ont.		
W. J. Tyers, Belleville, Ont.		
C. F. Warcup, St. Thomas, Ont.		
J. Wilson, Hamilton, Ont.		
Grand Trunk Pacific Ry.	1	3,627
L. H. Wheaton, Dartmouth, N. S.		
Great Northern Ry.,	2	8,102
J. A. Bohland. St. Paul, Minn.		
H. A. Gerst, St. Paul, Minn.		
Gulf, Colorado and Santa Fe Ry.	5	1,937
Z. A. Green, Galveston, Tex.		
K. S. Hull, Temple, Tex.		
G. A. Knapp, Galveston, Tex.		
W. G. Massenburg, Beaumont, Tex.		
W. W. Wilson, Galveston, Tex.		
Illinois Central R. R.,	13	4,767
P. Aagaard, Chicago, Ill.		
Chas. Dale, New Orleans, La.		
F. O. Draper, Chicago, Ill.		
C. Ettinger, Chicago, Ill.		
Maro Johnson, Chicago, Ill.		
C. R. Knowles, Chicago, Ill.		
O. W. Lentz, Chicago, Ill.		
S. P. Munson, Mattoon, Ill.		
W. L. Ratliff, McComb, Miss.		
M. A. Smith, New Orleans, La.		
O. M. Suter, Chicago, Ill.		
F. L. Thompson, Chicago, Ill.		
E. F. Wise (retired), Waterloo, Ia.		
Illinois Traction System	2	425
G. W. Black, Mackinaw, Ill.		
G. A. Wright, Decatur, Ill.		
Imperial Govt. Rys. of Japan	1	1,000
S. Kurokochi, Tokyo, Japan.		
International & Great Northern Ry.	1	1,106
H. M. Jack, Palestine, Tex.		
Kansas City, Clinton & Springfield Ry.	1	155
J. B. Browne, Clinton, Mo.		
Kansas City Southern Ry.	3	826
W. W. Casey, Texarkana, Tex.		
C. E. Johnston, Kansas City, Mo.		
J. J. Taylor, Texarkana, Tex.		

Name of Road and Membership.	Members.	Mileage.
Lake Erie & Western R. R.,	1	882
P. P. Lawrence, Tipton, Ind.		
Lake Superior & Ishpeming Ry., Munising, Marquette & S. E. Ry.	2	160
August Anderson, Marquette, Mich.		
Roscoe C. Young, Marquette, Mich.		
Lehigh & Hudson River Railway	1	96
J. E. Barrett, Warwick, N. Y.		
Lehigh & New England R. R.	1	296
A. M. Snyder, Pen Argyl, Pa.		
Lehigh Valley R. R.,	10	1,443
E. B. Ashby, New York City.		
Peter Hofecker, Auburn, N. Y.		
J. W. Holcomb, Buffalo, N. Y.		
R. E. James, Sayre, Pa.		
Judson Joslin, Auburn, N. Y.		
A. E. Kemp, Hazleton, Pa.		
F. E. Schall, South Bethlehem, Pa.		
L. W. Swan, Easton, Pa.		
E. R. Wenner, Ashley, Pa.		
F. W. White, Wilkes-Barre, Pa.		
Long Island R. R.	8	399
E. L. Goldsmith, Jamaica, N. Y.		
Wm. G. Hicks, Jamaica, N. Y.		
M. Loeffler, Jamaica, N. Y.		
W. F. O'Connor, Flushing, N. Y.		
E. P. Self, Jamaica, N. Y.		
Chas. Wehlen, Jamaica, N. Y.		
W. Wicks, Amityville, N. Y.		
C. W. Wright, Jamaica, N. Y.		
Los Angeles & Salt Lake R. R.	5	1,100
D. H. Ashton, Salt Lake City, Utah.		
F. M. Bigelow, Salt Lake City, Utah.		
R. R. Bishop, Salt Lake City, Utah.		
W. C. Frazier, Los Angeles, Cal.		
J. C. Post, Los Angeles, Cal.		
Louisiana & Arkansas Ry.,	1	302
D. Zenor, Stamps, Ark.		
Louisville & Nashville, R. R., (and Nash. Term. Co.)	12	5 070
J. M. Bibb, Birmingham, Ala.		
A. J. Catchot, Ocean Springs, Miss.		
R. O. Elliott, Nashville, Tenn.		
H. R. Hill, Birmingham, Ala.		
Floyd Ingram, Erin, Tenn.		
T. H. King, Knoxville, Tenn.		
J. W. Little, Birmingham, Ala.		
A. B. McVay, Evansville, Ind.		
C. M. Roy, Birmingham, Ala.		
Wm. Sheley, Evansville, Ind.		
H. Stamler, Paris, Ky.		
W. G. Stewart, Nashville, Tenn.		
Louisiana & Northwest R. R.,	1	121
T. R. Barger, Homer, La.		

Name of Road and Membership.	Members.	Mileage.
Maine Central R. R.	1	1,206
P. N. Watson, Brunswick, Me.		
Michigan Central R. R.,	13	1,800
S. D. Bailey, Detroit, Mich.		
Grant Boyer, Detroit, Mich.		
G. H. Fenwick, St. Thomas, Ont.		
Thomas Hall, St. Thomas, Ont.		
F. J. Hodges, Jackson, Mich.		
Henry A. Horning, Jackson, Mich.		
J. S. Huntoon, Detroit, Mich.		
Andrew Leslie, St. Thomas, Ont.		
A. B. Nies, Jackson, Mich.		
W. H. Sellew, Detroit, Mich.		
E. W. Smith, Detroit, Mich.		
S. B. Thorn, Bay City, Mich.		
Geo. H. Webb, Detroit, Mich.		
Minneapolis & St. Louis R. R.	2	1,645
Ed. Gagnon, Minneapolis, Minn.		
G. S. Kibbey, Minneapolis, Minn.		
Minneapolis, St. Paul & Sault Ste. Marie Ry.,	3	4,020
O. C. Gongoll, Minneapolis, Minn.		
G. A. Manthey, Minneapolis, Minn.		
P. Swenson, Minneapolis, Minn.		
Mississippi Central R. R.	1	150
L. E. Faulkner, Hattiesburg, Miss.		
Miss. River & Bonne Terre Ry.	1	64
C. H. Fake, Bonne Terre, Mo.		
Missouri, Kansas & Texas Lines,	1	3,865
A. S. Clopton, Oklahoma City, Okla.		
Missouri, Oklahoma & Gulf Ry.	1	334
Chas. Harrison, Muskogee, Okla.		
Missouri Pacific R. R.,	29	7,293
E. E. Allard, St. Louis, Mo.		
T. H. Bridges, McGehee, Ark.		
Robert J. Bruce, St. Louis, Mo.		
W. L. Burnett, Eudora, Ark.		
J. E. Byrd, McGehee, Ark.		
W. E. Byrd, McGehee, Ark.		
H. W. Clark, Falls City, Nebr.		
A. H. Ferdina, St. Louis, Mo.		
C. Gnadt, Poplar Bluff, Mo.		
W. A Guire, Lake Providence, La		
Lon Graves, Dermott, Ark.		
J. C. Hargrove, McGehee, Ark.		
E. H. Harvey, Montrose, Ark.		
W. Hausgen, Sedalia, Mo.		
E. P. Hawkins, McGehee, Ark.		
E. A. Jackson, McGehee, Ark.		
W. J. Lacy, Poplar Bluff, Mo.		
C. W. Lamb, Pine Bluff, Ark.		
G. W. Land, McGehee, Ark.		
A. D. May, Little Rock, Ark.		

Name of Road and Membership.	Members.	Mileage.
Missouri Pacific R. R., continued.		
J. V. Reynolds, McGehee, Ark.		
D. L. Roper, Monroe, La.		
C. C. Runyon, Gorham, Ill.		
Wm. Smith, McGehee, Ark.		
Wm. Sullivan, Kansas City, Mo.		
F. W. Tanner, St. Louis, Mo.		
D. G. Tewksbury, Gorham, Ill.		
L. J. Wackerle, Osawatomie, Kans.		
A. L. Waits, St. Louis, Mo.		
Mobile & Ohio R. R.	1	1,122
W. B. Harris, Corinth, Miss.		
Morgan's La. & Tex. R. R. & S. S. Co.,	3	405
A. B. Ashmore, Lafayette, La.		
H. F. Jonas, Houston, Tex.		
H. Slabotsky, Lafayette, La.		
Nashville, Chattanooga & St. Louis Ry.	5	1,230
W. H. Fletcher (Retired), Nashville, Tenn.		
H. P. Hodges, Nashville, Tenn.		
Hunter McDonald, Nashville, Tenn.		
O. M. Sorrells, Atlanta, Ga.		
I. O. Walker, Atlanta, Ga.		
New Orleans & North Eastern R. R.,	4	196
L. E. Jones, New Orleans, La.		
O. R. McIlhenny, Laurel, Miss.		
J. S. Sharp, New Orleans, La.		
J. J. Steadham, New Orleans, La.		
New Orleans Great Northern	1	285
F. J. Bourgeois, Bogalusa, La.		
New Orleans, Mobile & Chicago R. R.	1	403
P. K. Lutken, Laurel, Miss.		
New Orleans, Texas & Mexico R. R.	1	287
J. P. Yates, DeQuincy, La.		
New South Wales Government Rys.,	1	3,967
James Fraser, Sydney, N. S. W.		
New York Central R. R.,	17	5,032
J. K. Bonner, Rochester, N. Y.		
W. S. Haley, Toledo, O.		
U. S. Hitesman, New York City.		
G. J. Klumpp, Rochester, N. Y.		
R. P. Mills, New York City.		
Philip O'Neill, Adrian, Mich.		
Kemper Peabody, N. Y. City.		
W. A. Pettis, Rochester, N. Y.		
R. H. Reid, Cleveland, O.		
E. J. Rykenboer, Rochester, N. Y.		
S. A. Seely, Utica, N. Y.		
J. L. Soisson, Norwalk, O.		
W. F. Steffens, New York City.		
L. W. Stone, Oswego, N. Y.		
E. R. Tattershall, Malone, N. Y.		
H. C. Thompson, Weehawken, N. J.		
E. E. Wilson, New York City.		

Name of Road and Membership.	Members.	Mileage.
New York, New Haven & Hartford R. R.	18	2,003
C. L. Beeler, New Haven, Conn.		
J. S. Browne, New Haven, Conn.		
Eldridge E. Candee, New London, Conn.		
Elliot E. Candee, Waterbury, Conn.		
H. H. Kinzie, Taunton, Mass.		
A. G. McKay, New Haven, Conn.		
W. V. Lattin, Hartford, Conn.		
E. C. Littlefield, New Haven, Conn.		
Wm. H. Moore, New Haven, Conn.		
E. O. Newton, Danbury, Conn.		
B. P. Phillips, Willimantic, Conn.		
L. H. Porter (retired), Andover, Conn.		
George A. Rodman, New Haven, Conn.		
George T. Sampson, Boston, Mass.		
W. B. Schuessler, Waterbury, Conn.		
D. W. Sharpe (Retired), New Haven, Conn.		
J. B. Sheldon, Providence, R. I.		
J. J. Wishart, Boston, Mass.		
New York, Ontario & Western Ry.	1	494
J. H. Nuelle, Middletown, N. Y.		
Northern Ry. (Costa Rica),	1	375
M. M. Marsh, Squirres, Costa Rica, C. A.		
Northern Pacific Ry.,	4	6,727
E. H. Brown, Minneapolis, Minn.		
James Hartley, Staples, Minn.		
F. Ingalls, Jamestown, N. D.		
C. S. McCully, Jamestown, N. D.		
Northwestern Pacific R. R.,	1	469
A. A. Robertson, San Rafael, Cal.		
Oakland, Antioch & Eastern Ry.	1	115
W. B. Noland, Sacramento, Cal.		
Oregon Short Line R. R.	26	2,256
E. S. Airmet, Salt Lake City, Utah.		
L. W. Althof, Pocatello, Idaho.		
N. D. Brookhart, Pocatello, Idaho.		
F. P. Cullen, Pocatello, Idaho.		
J. F. Cullen, Pocatello, Idaho		
E. A. Demars, Salt Lake City, Utah.		
I. A. Draper, Pocatello, Idaho.		
Fred Gaunt, Pocatello, Idaho.		
Rupert Hansen, Salt Lake City, Utah.		
C. J. Harris, Roberts, Idaho.		
C. A. Harshbarger, Ontario, Ore.		
J. A. Kelly, Pocatello, Idaho.		
A. H. King, Pocatello, Idaho.		
Roy McRostie, Pocatello, Idaho.		
C. T. Musgrave, Idaho Falls, Idaho.		
R. Newton, Pocatello, Idaho.		
P. E. Parsons, Salt Lake City, Utah.		
E. E. Paterson, Pocatello, Idaho.		
C. G. Pitcher, Pocatello, Idaho.		
S. J. Powell, Ogden, Utah.		
A. W. Robinson, Salt Lake City, Utah.		

Name of Road and Membership.	Members.	Mileage.
Oregon Short Line R. R. Continued.		
R. B. Robinson, Salt Lake City, Utah.		
Parker Shifflet, Pocatello, Idaho.		
Wm. Sorensen, Brigham, Utah.		
A. R. Stevens, Pocatello, Idaho.		
D. T. Wells, Salt Lake City, Utah.		
Pacific Electric Ry., ...	6	1,047
Alf Brown, Los Angeles.		
C. F. Estes, Los Angeles, Cal.		
B. F. Manley, Los Angeles, Cal.		
D. E. Plank, Los Angeles, Cal.		
J. R. Shean, Los Angeles, Cal.		
J. F. Zorn, Los Angeles, Cal.		
Pennsylvania Lines West of Pittsburgh....................	9	4,161
T. O. Andrews, Lebanon, Ind.		
Samuel C. Bowers, Steubenville, O.		
B. F. Gehr, Richmond, Ind.		
A. F. Miller, Chicago. Ill.		
D. G. Musser, Wellsville, O.		
H. H. Pollock, Carnegie, Pa.		
W. F. Rankin, Cambridge, O.		
J. Wallenfelsz, Cambridge, O.		
D. C. Zook, Fort Wayne, Ind.		
Pennsylvania R. R.	4	5,379
M. M. Barton (Retired), W. Philadelphia, Pa.		
H. R. Leonard, Philadelphia, Pa.		
Robert McKibben, Altoona, Pa.		
A. W. Reynolds, Jersey City, N. J.		
Pere Marquette R. R.	14	2,262
J. D. Black, Saginaw, Mich.		
Thos. Brown, Saginaw, Mich.		
J. J. Evans, Saginaw, Mich.		
Edw. Guild, Grand Ledge, Mich.		
G. E. Hanks (retired), East Saginaw, Mich.		
C. H. Johnson, Reese, Mich.		
A. L. McCloy, Reese, Mich.		
A. McNab, Holland, Mich.		
Homer Morgan, Greenville, Mich.		
John Robinson, Grand Rapids, Mich.		
J. E. Toohey, Grand Rapids, Mich.		
C. F. Weir, St. Thomas, Ont.		
G. Y. Whitmee, Grand Rapids, Mich.		
J. P. Wood, Saginaw, Mich.		
Philadelphia & Reading Ry.	5	1,582
Amos H. Beard (retired), Reading, Pa.		
Franklin Gable, Catawissa, Pa.		
G. M. Hoffman, Shamokin, Pa.		
E. G. Storck, Philadelphia, Pa.		
E. E. Templin, Pottsville, Pa.		
Pittsburgh & Lake Erie R. R.	1	224
D. L. McKee, McKee's Rocks, Pa.		
San Antonio & Aransas Pass Ry.	2	724
F. W. Bailey, Yoakum, Tex.		
J. D. Lacy, Houston, Tex.		

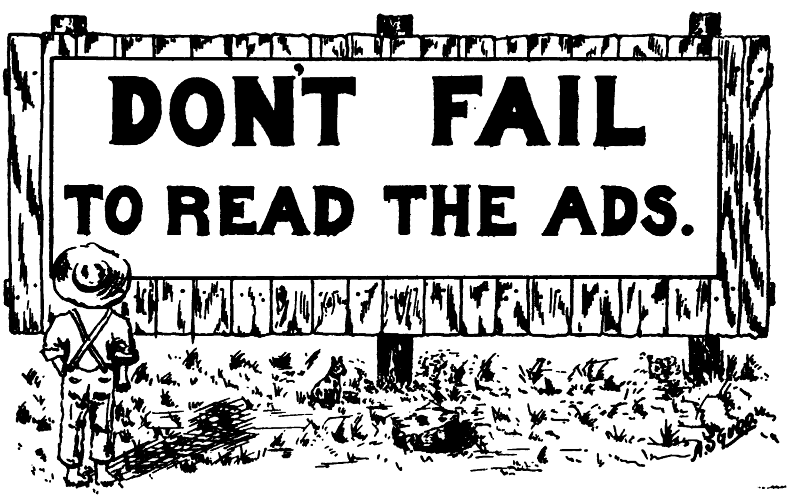
Name of Road and Membership.	Members.	Mileage.
Seaboard Air Line Ry.,	6	3,449
C. F. Ballard, Peachland, N. C.		
J. E. Eubanks, Yulee, Fla.		
W. J. Galloway, Hamlet, N. C.		
W. A. McDearmid, Charleston, S. C.		
J. C. Nelson, Norfolk, Va.		
J. L. Winter, Waldo, Fla.		
St. Joseph & Grand Island Ry.,	2	258
Wm. Carmichael, St. Joseph, Mo.		
G. T. Ray, Marysville, Kans.		
St. Louis & San Francisco R. R.	1	4,740
F. G. Jonah, St. Louis, Mo.		
St. Louis Southwestern Ry.,	4	1,685
J. S. Berry, St. Louis, Mo.		
W. V. Parker, Malden, Mo.		
Wm. Quinn, Tyler, Tex.		
W. H. Vance, Tyler, Tex.		
Shreveport, Alexandria & S. W. Ry.,	1	138
W. Vandercook, Lake Charles, La.		
Southern Ry.,	7	7,922
R. E. Connor, Columbia, S. C.		
N. L. Hall, Greensboro, N. C.		
J. S. Lemond, Charlotte, N. C.		
C. A. Redinger, Old Fort, N. C.		
T. E. Sharpe, Greenville, S. C.		
J. B. Teaford, Louisville, Ky.		
G. W. Welker, Alexandria, Va.		
Southern New England Ry.,	3	85
J. E. Cole, Providence, R. I.		
R. D. Garner, Providence, R. I.		
W. A. Leach, Providence, R. I.		
Southern Pacific Company,	67	6,950
H. L. Archbold, Los Angeles, Cal.		
T. W. Bratten, Oakland Pier, Cal.		
C. W. Brown, Mina, Nev.		
H. Bulger, Oakland Pier, Cal		
F. L. Burckhalter, Portland, Ore.		
W. H. Burgess, Stockton, Cal.		
D. Burke, Tucson, Ariz.		
W. E. Burns, San Francisco, Cal.		
J. T. Caldwell, Bakersfield, Cal.		
J. H. Clark, Los Angeles, Cal.		
W. S. Corbin, San Pedro, Cal.		
D. M. Crosman, Los Angles, Cal.		
Geo. Dickson, Oakland, Cal.		
F. C. Dittmar, Los Angeles, Cal.		
R. M. Drake, San Francisco, Cal.		
G. A. Easton, West Oakland, Cal.		
B. F. Ferris, Los Angeles, Cal.		
J. F. Fisher, Sacramento, Cal.		
M. Fisher, Ogden, Utah.		
A. Fraser, Bakersfield, Cal.		
Neil Fraser, Dunsmuir, Cal.		
Ira Gentis, Oakland, Cal.		

Name of Road and Membership.	Members.	Mileage.
Southern Pacific Company. Continued.		
P. Giusto, San Francisco, Cal.		
J. A. Given, Sacramento, Cal.		
Jas. Gratto, Los Angeles, Cal.		
C. F. Green, Sacramento, Cal.		
H. A. Hampton, Portland, Ore.		
Robt. Hansen, West Oakland, Cal.		
W. C. Harman, Bakersfield, Cal.		
J. M. Hinchee, Los Angeles, Cal.		
J. A. Hutchens, Ogden, Utah.		
Jno. D. Isaacs, New York City.		
C. A. Jensen, Los Angeles, Cal.		
H. Lodge, San Francisco, Cal.		
C. W. McCandless, Ventura, Cal.		
J. C. McClure, Los Angeles, Cal.		
D. McGee, Sacramento, Cal.		
A. M. McLeod, Oakland, Cal.		
J. B. Malloy, San Francisco, Cal.		
J. D. Mathews, Tucson, Ariz.		
F. D. Mattos, W. Oakland, Cal.		
M J Mayer, San Francisco, Cal.		
A. T. Mercier, Los Angeles, Cal.		
E. C. Morrison, San Francisco, Cal.		
J J. Murphy, Oakland, Cal.		
R. E. Murphy, Bakersfield, Cal.		
P. N. Nelson, San Francisco, Cal.		
Harry Pollard, San Francisco, Cal.		
Homer Pollard, West Oakland, Cal.		
Geo. W. Rear, San Francisco, Cal.		
J. S. Replogle, Oakland, Cal.		
D. B. Rich, Stockton, Cal.		
D. T. Rintoul, Bakersfield. Cal.		
Norman Rose, Portland, Ore.		
W. M. Rose, Sacramento, Cal.		
Niles Searls, San Francisco, Cal.		
Fred Secord, Sacramento, Cal.		
G. W. Sedwell, Bakersfield, Cal.		
T. H. Settle, Los Angeles, Cal.		
F. M. Siefer, Sacramento, Cal.		
C. W. Smith, Portland, Ore.		
Thos. Tretheway, Stockton, Cal.		
W. F. Turner, Ogden, Utah.		
E. J. Vincent, Los Angeles, Cal.		
A. Weldon, Bakersfield, Cal.		
C. R. Wells, Sacramento, Cal.		
M. M. Wilson, Los Angeles, Cal.		
South Manchuria Ry.	1	2,000
Y. Maruyama, Dairen, Japan.		
Temiskaming & Northern Ontario Ry.,	2	320
G. H. Dickson, North Bay, Ont.		
W. J. Oldham, North Bay, Ont.		
Texas & Pacific Ry.	1	1,944
E. Loughery, Dallas, Tex.		
Texas Midland R. R.	1	125
E. H. R. Green, Terrell, Tex.		
The Thousand Islands Ry.	1	20
H. A. Cooper, Gananoque, Ont.		

Name of Road and Membership.	Members.	Mileage.
Toledo, Peoria & Western Ry.	1	248
J. H. Markley, Peoria, Ill.		
Toledo Railways & Light Co.,	1	110
A. Swartz, Sylvania, O.		
Trinity & Brazos Valley Ry.,	2	466
B. M. Hudson, Teague, Tex.		
R. W. Smith, Teague, Tex.		
Union Pacific System	1	7,825
J. Parks, Denver, Colo.		
Union Traction Co. of Ind.	2	460
Jno. Hancock, Anderson, Ind.		
L. A. Mitchell, Anderson, Ind.		
Wabash R. R.	3	2,519
A. O. Cunningham, St. Louis, Mo.		
E. C. Danes, Peru, Ind.		
William S. Danes, Peru, Ind.		
Washington Terminal Co.,	1	53
W. M. Cardwell, Washington, D. C.		
Western & Atlantic R. R.	1	137
D. E. Counts, Dalton, Ga.		
Western Australia Government Rys.	1	1,943
E. S. Hume, Midland Jct., Western Australia.		
Western Pacific Ry.	1	946
T. J. Stuart, Elko, Nev.		
Wheeling & Lake Erie R. R.	3	459
Wm. Mahan, Canton, O.		
W. L. Rohbock, Cleveland, O.		
Yazoo & Miss. Valley R. R.	2	1,370
D. H. Holdridge, Vicksburg, Miss.		
W. Shropshire, Greenville, Miss.		

No. of Railroads Represented,	129	
Total, Members and Mileage,	636	251,945
Members not with Railroads,	69	
Total Membership,	705	

INDEX TO ADVERTISEMENTS


DONT FAIL
TO READ THE ADS.

Jameson Roofing Company, Roofing Contractor

This is the Bond that guarantees yuor roof for 20 years

America's Largest Dye Plant Is Covered with Barrett Specification Roofs—

THE National Aniline & Chemical Company, Inc., is the biggest concern in the new American industry.

It has plants in various parts of the country and today is turning out dyes equal in every way to those formerly produced in Germany.

Its most important plant is the Schoellkopf Works located at Buffalo, N. Y., illustrated herewith.

This plant was designed and constructed by The John W. Cowper Company, one of the largest firms of engineers in this country, and it represents the very best in building construction.

Quite naturally Barrett Specification Roofs were chosen to cover the various buildings in preference to any other type because the experience of many years has demonstrated that these roofs have a longer life than any other and cost less per year of service. The reasons for their long life are:

First,
because they are constructed of Barrett Specification Pitch and Felt, *the greatest waterproofing materials known.*

Second,
because a *greater amount* of waterproofing is used in Barrett Specification Roofs than in any other kind of roof-covering, and the amount of waterproofing material in the roof largely determines its life.

Third,
because under the 20-Year Guaranty Plan the roofs must be constructed *under the supervision of our inspectors,* and we know, therefore, that they will be constructed right.

In view of all this, do you wonder that Barrett Specification Roofs are more popular than any other type for use on permanent buildings of all kinds?

The 20-Year Guaranty Bond

We are now prepared to give a 20-Year Surety Bond on all Barrett Specification Roofs of fifty squares and over, in all towns in the United States and Canada with a population of 25,000 and over, and in *smaller places where our Inspection Service is available.*

Our only requirements are that The Barrett Specification dated May 1, 1916 shall be strictly followed and that the roofing contractor shall be approved by us.

Copies of The Barrett 20-Year Specification, with roofing diagrams, mailed free on request.

The Barrett Company

New York Chicago Philadelphia Boston St. Louis Cleveland Cincinnati Pittsburgh Detroit Birmingham Kansas City Minneapolis Salt Lake City Nashville Seattle Peoria

THE BARRETT COMPANY, Limited: Montreal Toronto Winnipeg Vancouver St. John, N. B. Halifax, N. S. Sydney, N. S.

The VERY NEWEST THING in

Hydrants

FOR

Coach Yards, Cinder Pits, at Stations

AND FOR

FIRE LINES

FIGS. 10, 62 and 59 are all you need from us, to make 3-4 in. or 1 in. hydrants such as Fig. 67, use your own 2 1-2 in. pipe for an outside casing. This idea embraces the 3-4 in., 1 in., 1 1-4 in., 1 1-2 in., 2 in. and 2 1-2 in. sizes, uses less metered water and will stand more abuse than any other type on the market. During November, 1916, we mailed a number of new Bulletins to all Supvr's, M. C., and Water Service men of record at that time. If any one failed to get same write us.

Fig. 67

Fig. 10

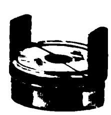


Fig. 62
For $\frac{3}{4}$ and 1 in.
75c each, net

Fig. 59
For $\frac{3}{4}$ and 1 in.
$1.00 each, net

Volkhardt Company, *Inc.*

Home Office:

15 Townsend Ave., Staten Island, New York City

Western Agents: Squire-Cogswell Co., 537 So. Dearborn St., Chicago, Ill.

The Successful

Poage Water Column

with Fenner Drop Spout

The Reasons Why:

¶ The Flexible Fenner Drop Spout has a **FIVE FOOT VERTICAL and THREE FOOT LATERAL** movement. It also can be pulled out or in—longer or shorter than normal length. This flexibility prevents water waste. It saves a great amount of time in taking water, as accurate spotting of the locomotive is unnecessary. It acts as a big maintenance saver in that the spout will move should the locomotive shift. Many water columns with more rigid spouts are knocked down because of the shifting of the locomotive while taking water.

¶ **THE SPOUT IS ABSOLUTELY NON-FREEZABLE.** There is no packing or working parts in the joint. It is **OPEN TELESCOPIC.**

¶ The water is **AUTOMATICALLY** shut off and the spout when released returns parallel to the track by gravity.

¶ The entire mechanism is very simple and the few parts that compose it are built with an extra margin of strength.

¶ Write for the booklet with complete information **TODAY.**

Manufactured by

The American Valve & Meter Co.

Cincinnati, U. S. A.

WILL make your buildings safe when sparks fly from passing engines.

AND when the big storms come, they will keep your buildings dry. And after years and years fly by, these shingles will be found as serviceable as ever.

No breakage in transit or handling
Laid by any competent mechanic

There is nothing more suitable for Railroad Buildings

CORTRIGHT METAL ROOFING CO.

Philadelphia, Pa. **Chicago, Ill.**

Robert W. Hunt. Jno. J. Cone Jas. C. Hallsted D. W. McNaugher

Robert W. Hunt & Co.

Engineers Inspectors Chemists

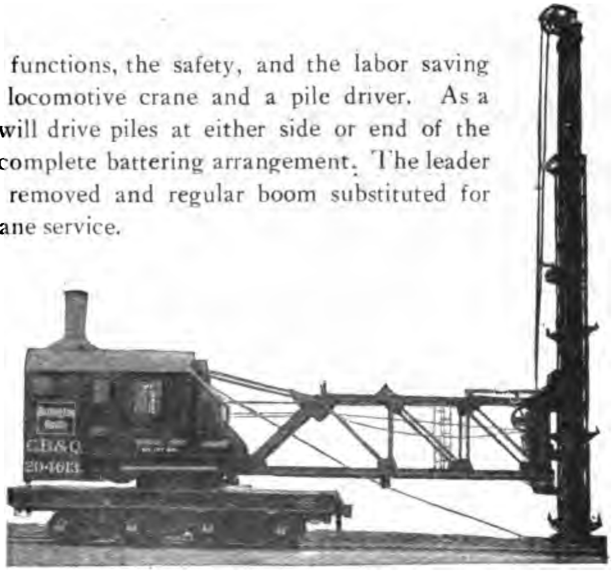
Inspection and Tests
Structural and Reinforcing Steel and Machinery for Bridges, Buildings and Other Structures
Inspection and Tests
Cement, Creosoted Blocks, Timbers and Ties
Rails and Track Materials
Inspectors permanently located at manufacturing plants
Supervision of Construction

General Offices: CHICAGO
2200 Insurance Exchange

New York	Pittsburgh	St. Louis	San Francisco
Cincinnati	Montreal	Dallas	Seattle

An INDUSTRIAL WORKS
Convertible Crane Pile Driver

combines the functions, the safety, and the labor saving abilities of a locomotive crane and a pile driver. As a pile driver it will drive piles at either side or end of the car. It has a complete battering arrangement. The leader truss is easily removed and regular boom substituted for locomotive crane service.



Industrial Works
Bay City, Mich.

Locomotive and Wrecking Cranes, 5 to 150 tons capacity, Pile Drivers, Transfer Tables Pillar Cranes, Railsaws, Transfer Cranes, Steam Hammers, Grab Buckets

---

WRITE US TODAY FOR OUR SPECIAL

Club Subscription Proposition

FOR MEMBERS ONLY of the AMERICAN RAILWAY BRIDGE and BUILDING ASSOCIATION

Mr. W. M. CAMP, author of "Camp's Notes on Track" and a member of the A. R. B. & B. A. for many years writes interesting and instructive articles regularly which no man interested in bridge and building construction should miss. In writing be sure and state that you are a member of the A. R. B. & B. A.

RAILWAY REVIEW

537 So. Dearborn St. CHICAGO, ILL.